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A FRAMEWORK SEASONAL ADJUSTMENT OF HARVEST PROCEDURES, REFERENCE POINTS, AND STATUS CRITERIA UNDER THE FISHERY MANAGEMENT PLAN FOR COASTAL MIGRATORY PELAGIC RESOURCES IN THE GULF OF MEXICO INCLUDING ENVIRONMENTAL ASSESSMENT, REGULATORY IMPACT REVIEW, AND INITIAL REGULATORY FLEXIBILITY ANALYSIS

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ABBREVIATIONS USED IN THIS DOCUMENT

ABC	Acceptable Biological Catch
AP	Advisory Panel
B	Spawning Stock Biomass
B_{MSY}	Biomass at MSY
BRD	Bycatch Reduction Device
CEQ	Council On Environmental Quality
CPUE	Catch Per Unit Effort
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EST	Eastern Standard Time
F	Rate of Instantaneous Fishing Mortality
F_{MSY}	Fishing Mortality Rate at MSY
FL	Fork Length
FMP	Fishery Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
HCD	Habitat Conservation Division
IFQ	Individual Fishing Quota
IRFA	Initial Regulatory Flexibility Analysis
M	Natural Mortality
MEY	Maximum Economic Yield
MFMT	Maximum Fishing Mortality Threshold
MP	Million Pounds
MSAP	Mackerel Stock Assessment Panel
M-SFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
OY	Optimum Yield
PPT	Parts Per Thousand
RFA	Regulatory Flexibility Act of 1980
RIR	Regulatory Impact Review
SAFMC	South Atlantic Fisheries Management Council
SBA	Small Business Administration
SFA	Sustainable Fisheries Act
SEIS	Supplemental Environmental Impact Statement
SEP	Socioeconomic Panel
SPR	Spawning Potential Ratio
SSB	Spawning Stock Biomass
SSC	Scientific and Statistical Committee
TAC	Total Allowable Catch
TL	Total Length
TPWD	Texas Parks and Wildlife Department
VPA	Virtual Population Analysis

I. HISTORY OF MANAGEMENT

Species in the Management Unit of the Coastal Migratory Pelagics FMP

King mackerel	*Scomberomorus cavalla*
Spanish mackerel	*S. maculatus*
Cobia	*Rachycentron canadum*

Species in the Coastal Migratory Pelagics FMP but not in the Management Unit

Cero	*S. regalis*
Little tunny	*Euthynnus alletteratus*
Dolphin	*Coryphaena hippurus*
Bluefish (Gulf of Mexico only)	*Pomatomus saltatrix*

The Coastal Migratory Pelagics "Mackerel" fishery management plan (FMP) was approved in 1982 and implemented by regulations effective in February of 1983. It treated king and Spanish mackerel as unit stocks in the Atlantic and Gulf of Mexico. The FMP established allocations for the recreational and commercial sectors harvesting these stocks, and the commercial allocations were divided between net and hook-and-line fishermen.

FMP Amendments

Amendment 1, implemented in September of 1985, provided a framework procedure for pre-season adjustment of total allowable catch (TAC), revised king mackerel maximum sustainable yield (MSY) downward, recognized separate Atlantic and Gulf migratory groups of king mackerel, and established fishing permits and bag limits for king mackerel. Commercial allocations among gear users, except purse seines that were allowed 6% of the commercial allocation of TAC, were eliminated. The Gulf commercial allocation for king mackerel was divided into Eastern and Western Zones for the purpose of regional allocation, with 69% of the remaining allocation provided to the Eastern Zone and 31% to the Western Zone. Amendment 1 also established minimum size limits for Spanish mackerel at 12 inches fork length (FL) or 14 inches total length (TL) and for cobia at 33 inches FL or 37 inches TL.

Amendment 2, implemented in July of 1987, revised Spanish mackerel MSY downward, recognized two migratory groups, established allocations of TAC for the commercial and recreational sectors, and set commercial quotas and bag limits. Charterboat permits were required, and it was clarified that TAC must be set below the upper range of acceptable biological catch (ABC). The use of purse seines on overfished stocks was prohibited, and their allocation of TAC was redistributed under the 69%/31% split.

Amendment 3 was partially approved in August 1989, revised, resubmitted, and approved in April 1990. It prohibited drift gill nets for coastal pelagics and purse seines for the overfished groups of mackerels.

Amendment 4, implemented in October 1989, reallocated Spanish mackerel equally between recreational and commercial fishermen on the Atlantic group.

Amendment 5, implemented in August 1990, made the following changes in the management regime:

- Extended the management area for Atlantic groups of mackerels through the Mid-Atlantic Council's area of jurisdiction;
- Revised problems in the fishery and plan objectives;
- Revised the fishing year for Gulf Spanish mackerel from July-June to April-March; Revised the definition of "overfishing;"
- Added cobia to the annual stock assessment procedure;
- Provided that the South Atlantic Fishery Management Council (SAFMC) will be responsible for pre-season adjustments of TACs and bag limits for the Atlantic migratory groups of mackerels while the Gulf of Mexico Fishery Management Council (Council or GMFMC) will be responsible for Gulf migratory groups;
- Continued to manage the two recognized Gulf migratory groups of king mackerel as one until management measures appropriate to the eastern and western groups can be determined;
- Re-defined recreational bag limits as daily limits;
- Deleted a provision specifying that bag limit catch of mackerel may be sold;
- Provided guidelines for corporate commercial vessel permits;
- Specified that Gulf group king mackerel may be taken only by hook-and-line and run-around gill nets;
- Imposed a bag and possession limit of two cobia per person per day;
- Established a minimum size of 12 inches (30.5 cm.) fork length (FL) or 14 inches (35.6 cm.) total length (TL) for king mackerel and included a definition of "conflict" to provide guidance to the Secretary.

Amendment 6, implemented in November of 1992, made the following changes:

- Identified additional problems and an objective in the fishery;
- Provided for rebuilding overfished stocks of mackerels within specific periods;
- Provided for biennial assessments and adjustments;
- Provided for more seasonal adjustment actions;
- Allowed for Gulf king mackerel stock identification and allocation when appropriate;
- Provided for commercial Atlantic Spanish mackerel possession limits;
- Changed commercial permit requirements to allow qualification in one of three preceding years;
- Discontinued the reversion of the bag limit to zero when the recreational quota is filled;
- Modified the recreational fishing year to the calendar year; and

- Changed the minimum size limit for king mackerel to 20 inches FL, and changed all size limit measures to fork length only.

Amendment 7, implemented in November 1994, equally divided the Gulf commercial allocation in the Eastern Zone at the Dade-Monroe County line in Florida. The suballocation for the area from Monroe County through Western Florida is equally divided between commercial hook-and-line and net gear users.

Amendment 8, implemented March 1998, made the following changes to the management regime:

- Clarified ambiguity about allowable gear specifications for the Gulf group king mackerel fishery by allowing only hook-and-line and run-around gill nets. However, catch by permitted, multi-species vessels and bycatch allowances for purse seines were maintained;
- Established the Council's intent to evaluate the impacts of permanent jurisdictional boundaries between the GMFMC and SAFMC and development of separate FMPs for coastal pelagics in these areas;
- Established a moratorium on commercial king mackerel permits until no later than October 15, 2000, with a qualification date for initial participation of October 16, 1995;
- Increased the income requirement for a king or Spanish mackerel permit to 25% of earned income or $10,000 from commercial sale of catch or charter or head boat fishing in 1 of the 3 previous calendar years, but allowed for a 1-year grace period to qualify under permits that are transferred;
- Legalized retention of up to 5 cut-off (barracuda damaged) king mackerel on vessels with commercial trip limits;
- Set an optimum yield (OY) target at 30% static spawning potential ratio (SPR);
- Provided the SAFMC with authority to set vessel trip limits, closed seasons or areas, and gear restrictions for Gulf group king mackerel in the North Area of the Eastern Zone (Dade/Monroe to Volusia/Flagler County lines);
- Established various data consideration and reporting requirements under the framework procedure;
- Modified the seasonal framework adjustment measures and specifications (see Appendix I);

Amendment 9, implemented in April 2000, made the following changes to the management regime:

- Reallocated the percentage of the commercial allocation of TAC for the North Area (Florida east coast) and South/West Area (Florida west coast) of the Eastern Zone to 46.15% North and 53.85% South/West and retained the recreational and commercial allocations of TAC at 68% recreational and 32% commercial;

- Subdivided the commercial hook-and-line king mackerel allocation for the Gulf group, Eastern Zone, South/West Area (Florida west coast) by establishing 2 subzones with a dividing line between the 2 subzones at the Collier/Lee County line;
- Established regional allocations for the west coast of Florida based on the 2 subzones with 7.5% of the Eastern Zone allocation of TAC being allowed from Subzone 2 and the remaining 92.5% being allocated as follows:
  50% - Florida east coast
  50% - Florida west coast that is further subdivided:
    50% - Net Fishery
    50% - Hook-and-Line Fishery
- Established a trip limit of 3,000 pounds per vessel per trip for the Western Zone;
- Established a moratorium on the issuance of commercial king mackerel gill net endorsements and allow re-issuance of gill net endorsements to only those vessels that: (1) had a commercial mackerel permit with a gill net endorsement on or before the moratorium control date of October 16, 1995 (Amendment 8), and (2) had landings of king mackerel using a gill net in one of the two fishing years 1995-96 or 1996-97 as verified by the National Marine Fisheries Service (NMFS) or trip tickets from the FDEP; allowed transfer of gill net endorsements to immediate family members (son, daughter, father, mother, or spouse) only; and prohibited the use of gill nets or any other net gear for the harvest of Gulf group king mackerel north of an east/west line at the Collier/Lee County line
- Increased the minimum size limit for Gulf group king mackerel from 20 inches to 24 inches FL;
- Allowed the retention and sale of cut-off (damaged), legal-sized king and Spanish mackerel within established trip limits.

Amendment 10, approved June 1999, incorporated essential fish habitat (EFH) provisions for the SAFMC.

Amendment 11, partially approved in December 1999, included proposals for mackerel in the SAFMC's Comprehensive Amendment Addressing Sustainable Fishery Act Definitions and other Provisions in Fishery Management Plans of the South Atlantic Region.

Amendment 12, approved October 2000, extended the commercial king mackerel permit moratorium from its current expiration date of October 15, 2000 to October 15, 2005, or until replaced with a license limitation, limited access, and/or individual fishing quota or individual transferable quota system, whichever occurs earlier.

Amendment 13, implemented August 19, 2002 established two marine reserves in the Exclusive Economic Zone (EEZ) in the vicinity of the Dry Tortugas, Florida known as Tortugas North and Tortugas South in which fishing for coastal migratory pelagic species is prohibited. This action complements previous actions taken under the National Marine Sanctuaries Act.

Amendment 14, implemented 7/29/02, established a 3-year moratorium on the issuance of charter vessel and head boat permits unless sooner replace by a comprehensive effort limitation system. The control date for eligibility was established as March 29, 2001. Also includes other provisions for eligibility, application, appeals, and transferability.

Framework Seasonal Adjustments (Regulatory Amendments):

Prior to the 1986 regulatory amendment, Amendment 1 established a TAC of 14.4 million pounds (MP). At the request of the Gulf Council in October 1985, NMFS implemented an emergency action in March 1986 that reduced TAC to 5.2 MP for the 1985-86 fishing year.

The 1986 regulatory amendment, submitted in May 1986, set TAC for Gulf group king mackerel at 2.9 MP with a 0.93 MP commercial quota and a 1.97 MP recreational allocation. The bag limits for Gulf group king mackerel for-hire and other recreational vessels were unchanged from those established under Amendment 1, i.e., 3 fish per person per trip, excluding captain and crew, or 2 fish including captain and crew, whichever is greater. For all other vessels, the bag limit was 2 fish per person per trip. The commercial quota was allocated 6% for purse-seines, 64.5% for all other commercial gear in the Eastern Zone (Florida) and 29% for all other gear in the Western Zone (AL-TX). The regulatory amendment also established criteria for allowing charterboats to obtain commercial permits and fish as either a charter or commercial vessel. It also provided that the recreational and commercial fisheries would be closed when their respective allocations were taken. These regulatory actions were implemented on July 1, 1986.

The 1987 regulatory amendment, submitted in May 1987, proposed a reduction in TAC for Gulf group king mackerel to 2.2 MP with the commercial quota set at 0.7 MP and a recreational allocation of 1.5 MP. The purse-seine allocation was set at zero; thus the commercial allocation was divided only between the Eastern and Western Zones at 69% and 31%, respectively. The TAC for Gulf group Spanish mackerel was set at 2.5 MP with a commercial quota of 1.4 MP and a recreational allocation for 1.1 MP. The bag limit for Gulf group king mackerel remained the same; and for Gulf group Spanish mackerel, it was set at 3 fish per person per trip. These regulatory actions were implemented on June 30, 1987.

The 1988 regulatory amendment, submitted May 1988, proposed to increase TAC for Gulf group king mackerel to 3.4 MP with a commercial allocation of 1.1 MP and a recreational allocation 2.3 MP. The TAC for Gulf group Spanish mackerel was increased to 5.0 MP with 2.15 MP allocated to the recreational sector and 2.85 MP to the commercial sector. The bag limit for Gulf group Spanish mackerel was set at 4 fish off Florida and 10 fish off AL-TX. These regulatory actions were implemented on July 1, 1988.

The regulatory amendment for 1989, submitted in May 1989, again proposed an increase in TAC for Gulf group king mackerel to 4.25 MP with a commercial quota 1.36 MP and a recreational allocation 2.89 MP. The bag limit remained unchanged. The TAC for Gulf group Spanish mackerel was requested to be increased to 5.25 MP, and the allocation ratio between the

commercial (57%) and recreational (43%) sectors would remain unchanged, as well as the bag limit. These regulatory actions were implemented on July 1, 1989.

The regulatory amendment for 1990, submitted May 1990, recommended that the TAC and bag limit for Gulf group king mackerel remain unchanged (4.25 MP and 2 fish per person, or 3 fish for charter persons when the captain and crew are excluded). The TAC for Gulf group Spanish mackerel (5.25 MP) also did not change; however, the bag limits for Spanish mackerel changed to 4 fish off FL, 3 fish off TX, and 10 Fish off AL-LA at the request of the states. These regulatory actions were implemented on August 1, 1990.

The 1991 regulatory amendment, submitted in May 1991, recommended that TAC for Gulf group king mackerel be increased to 5.75 MP with a 1.84 MP commercial quota and 3.91 MP recreational allocation. The bag limit for Gulf group king mackerel was modified to 2 fish off Florida and status quo (3 fish/2 fish) for AL-TX (see 1986 regulatory amendment discussion above). The TAC for Gulf group Spanish mackerel was increased to 8.6 MP with a 4.9 MP commercial allocation and a 3.7 MP recreational allocation. The bag limit was modified to 3 fish off TX, 5 fish off FL, and 10 fish off AL-LA. These regulatory actions were implemented on September 4, 1991.

The 1992 regulatory amendment, submitted in May 1992, proposed an increase in TAC for Gulf group king mackerel to 7.8 MP with a commercial quota of 2.50 MP and a recreational allocation of 5.3 MP. The king mackerel bag limit was reduced to 2 fish per person, including captain and crew of charter and head boats for the entire Gulf exclusive economic zone (EEZ). The TAC for Gulf group Spanish mackerel remained at 8.6 MP. The bag limits for Spanish mackerel were increased to 7 fish off TX, and 10 fish off FL-LA. These regulatory actions were implemented on September 18, 1992.

Because of increased catch on the west coast of Florida in 1992-93, an emergency action was taken by NMFS in February 1992 to add 259,000 pounds of Gulf group king mackerel to the 1992-93 TAC under a 25 fish trip limit. A second emergency action (October 1993) that was subsequently added to Amendment 7 equally divided the Eastern Zone allocation of TAC between the Florida east and west coasts. **The 1993 regulatory amendment**, submitted in July 1993, recommended that TAC and bag limits remain the same as in the 1992-93 fishing year for Gulf group king and Spanish mackerel. In the Eastern Zone (Florida) commercial hook and line fisheries, the trip limit for the Florida east coast was proposed at 50 fish until 50% of the subquota was taken, and then reduced to 25 fish. For the Florida west coast, no trip limit was recommended until 75% of the subquota was taken; afterwards, it would be reduced to 50 fish. These regulatory actions were implemented on November 1, 1993.

The 1994 regulatory amendment, submitted in June 1994, proposed a 25,000 pound trip limit for the gill net fishery until 90% of their allocation was taken, then 15,000 pounds per trip. When implementing this amendment on November 21, 1994, the NMFS rejected this step down; and commercial gill net boats fishing for king mackerel in the Eastern Zone (Florida) were limited to 25,000 pounds per trip. The TAC and bag limits remained unchanged for Gulf group

king mackerel; however, the trip limit for hook and line vessels on the Florida east coast was modified to 50 fish until 75% of their TAC allocation was taken, then it was reduced to 25 fish. The TAC and bag limits for Gulf group Spanish mackerel remained unchanged.

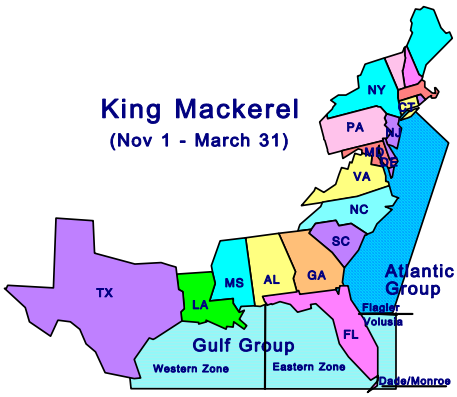
During the 1994-95 fishing year, mild weather, increased effort, or both, resulted in most of the commercial TAC allocation of Gulf group king mackerel for the west coast of Florida being taken before the fish migrated to the more historical fishing grounds in the Florida Keys. Consequently, the NMFS implemented an emergency rule in February 1995 that provided a supplemental allocation of 300,000 pounds under a 125 fish trip limit.

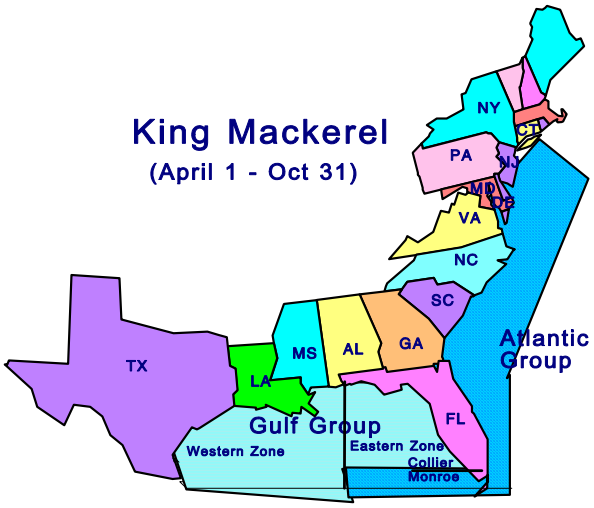
The 1995 regulatory amendment, submitted in May 1995, recommended that TAC and bag limits remain unchanged for Gulf group king and Spanish mackerel. The hook-and-line trip limit for the Florida west coast of the Eastern Zone was set at 125 fish until 75% of the subquota was taken, then it became 50 fish. For the east coast of Florida, the trip limit remained at 50 fish; however, if 75% of the quota was not taken by March 1, the 50-fish trip limit would remain in effect until the close of the season on March 31. These regulatory actions were implemented on December 18, 1995, with the exception of the 125 fish trip limit which became effective on November 22, 1995. Additionally, a control date for the commercial king mackerel fishery was published on October 16, 1995.

The 1996 regulatory amendment, submitted in August 1996, recommended that TAC and bag limits remain unchanged for Gulf group king mackerel, except that the bag limit for captain and crew of charter and head boats was set at zero. The commercial hook-and-line trip limit for the Florida west coast of the Eastern Zone was set at 1,250 pounds per trip until 75% of the subquota was taken; subsequently, it reverted to 500 pounds per trip until the suballocation was taken and the fishery closed. For the Florida east coast hook and line fishery, the trip limit was initially set at 750 pounds, but reverted to 500 pounds when 75 % of the suballocation was taken, provided that 75% of the quota was taken by February 15. If not, the trip limit remained at 750 pounds until the quota was taken or the season ended on March 31. The TAC for Gulf group Spanish mackerel was reduced to 7.0 MP; however, the bag limits remained unchanged. These regulatory actions were implemented on June 2, 1997.

The 1997 regulatory amendment, submitted in June 1997, recommended that TAC be increased to 10.6 MP for Gulf group king mackerel. The zero-fish bag limit for captain and crew of charter and head boats was rescinded. The commercial hook and line trip limit for the Florida east coast was changed to 50 fish until the subquota was taken. The TAC and bag limits remained unchanged for Gulf group Spanish mackerel. These regulatory actions were implemented on February 19, 1998.

The regulatory amendment for the 1998-1999 season, submitted July 1998, proposed to retain the TAC for Gulf group king mackerel at 10.6 MP, but reduced the bag limit for captain and crew of charter and head boats to zero. The minimum size limit for king mackerel was increased to 24 inches FL. The commercial king mackerel hook-and-line trip limit for the





Western Zone (AL-TX) was set at 3,000 pounds. These regulatory actions were implemented on September 20, 1999.

The regulatory amendment for the 1999-2000 season proposed to retain TAC for Gulf group king mackerel at 10.6 MP. It also proposed to establish a 2-fish per person per day bag limit on Gulf group king mackerel for the captain and crew of for-hire vessels and retain this 2-fish bag limit for all other recreational fishermen; however, the captain and crew bag limit was rejected by NMFS. The fishing season for the commercial gill net fishery for Gulf group king mackerel was changed to open at 6 a.m. eastern standard time (EST) on the Tuesday following the Martin Luther King, Jr. holiday, with the following weekend open as long as the quota has not been taken and all subsequent weekends and holidays would be closed as long as the season remains open. Weekend and holiday closures would be from 6 a.m. Saturday to 6 a.m. Monday EST (or Tuesday if a Monday federal holiday is involved), and during this period boats with a net on board must be tied to the dock. The TAC for Gulf group Spanish was changed from 7.0 MP to 9.1 MP, and the bag limit for Gulf group Spanish was increased from 10 to 15 fish per person per day. These regulatory actions were implemented on June 12, 2000.

The 2000-2001 regulatory amendment, submitted in July 2000, and approved on April 30, 2001 reduced TAC from 10.6 MP to 10.2 MP, provided a 2-fish bag limit for the captain and crew of for-hire vessels, and revised the trip limit for Gulf migratory group king mackerel in the northern area of the Eastern Zone (Miami-Dade through Volusia Counties, Florida) to remain at 50 fish until February 1. If the quota is not 75% filled as of February 1, then the trip limit will increase to 75 fish; if the quota is 75 % or greater, then the trip limit will remain at 50 fish.

The present management regime for king mackerel recognizes two migratory groups, the Gulf migratory group and the Atlantic migratory group. These groups are hypothesized to mix on the east coast of Florida. For management and assessment purposes, a boundary between groups was specified as the Volusia-Flagler County border on the Florida east coast in the winter (November 1-March 31) and the Monroe-Collier County border on the Florida southwest coast in the summer (April 1-October 31). For allocation of the commercial fishery, the Gulf migratory group is also divided into the Eastern and Western Zones at the Florida-Alabama border (Figure 1). The Eastern Zone is further subdivided into two subzones with 7.5% of the

allocation going to the area between the Alabama/Florida border and the Collier/Lee County line on the west coast of Florida. The remaining commercial share of TAC (92.5%) is allocated as follows:

50% - Florida east coast

50% - Florida west coast (Monroe and Collier Counties) that is further subdivided:

50% - Net Fishery

50% - Hook-and-Line Fishery

Spanish mackerel, cobia, little tunny, cero, and bluefish stocks are managed separately by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council in their respective jurisdictions. The allocation of TAC for Gulf group Spanish mackerel is 57% commercial and 43% recreational.

Management Objectives

The current FMP as amended lists eight plan objectives:

1. The primary objectives of the FMP are to stabilize yield at MSY, allow recovery of overfished populations, and maintain population levels sufficient to ensure adequate recruitment.

2. To provide a flexible management system for the resource which minimizes regulatory delay while retaining substantial Council and public input in management decisions and which can rapidly adapt to changes in resource abundance, new scientific information, and changes in fishing patterns among user groups or by areas.

3. To provide necessary information for effective management and establish a mandatory reporting system for monitoring catch.

4. To minimize gear and user group conflicts.

5. To distribute the TAC of Atlantic migratory group Spanish mackerel between recreational and commercial user groups based on the catches that occurred during the early to mid 1970's, which is prior to the development of the deep water run-around gill-net fishery and when the resource was not overfished.

6. To minimize waste and bycatch in the fishery.

7. To provide appropriate management to address specific migratory groups of king mackerel.

8. To optimize the social and economic benefits of the coastal migratory pelagic fisheries.

II. PURPOSE AND NEED FOR ACTION

The purpose of this regulatory amendment is to establish definitions of maximum sustainable yield (MSY), optimum yield (OY), the overfishing threshold, and the overfished condition for Gulf group king and Spanish mackerel, as well as cobia. Such definitions are required by Sections 303 (a)(3) and 303 (a)(10) of the Magnuson-Stevens Fishery Conservation and Management Act (M-SFCMA), and their development is guided by the National Standard Guidelines for National Standard 1 as promulgated under 50 CFR 600.310. These definitions were previously submitted under the Council's Generic Sustainable Fisheries Act Amendment; however, only the overfishing definitions were approved by NMFS. In disapproving the Council's definitions for MSY, OY, and the minimum stock size threshold (MSST) that serves as the proxy for the overfished condition, the NMFS noted that these proxy definitions were based on spawning potential ratios (SPR). The NMFS noted that although SPR was an acceptable proxy for the overfishing condition because it was based on a fishing mortality rate (F), SPR could not be used as a biomass based proxy that is required for MSY, OY, and MSST. Based on additional guidance and updated stock assessments, this regulatory amendment would establish revised definitions and proxies for MSY, OY, overfishing, and the overfished conditions for the aforementioned stocks. Having received and reviewed an updated stock assessment for Gulf group king mackerel in 2002, the Council through this regulatory amendment is also considering potential changes to the management regime for Gulf group king mackerel.

The best available scientific information indicates that the cobia stock currently managed under the joint coastal migratory pelagics FMP for the Gulf and South Atlantic is actually comprised of at least two separate migratory groups, as with king and Spanish mackerel. The most recent stock assessment upon which the status determination criteria in this amendment were based (Williams 2001) was only for the Gulf migratory group of the cobia stock. As a result, the estimates of MSY, OY, MSST, and MFMT in this regulatory amendment relating to cobia apply only to the Gulf migratory group of the stock. Since the stock, as yet, has not been officially established as two or more migratory groups in the FMP or any subsequent amendment, implementation of these criteria and any regulations flowing therefrom will be deferred pending formal establishment of the Gulf migratory group via the next Coastal Migratory Pelagics FMP amendment. At present, no new regulations would be required to restrict harvest of cobia to the OY levels selected in this amendment.

III. AFFECTED ENVIRONMENT

Description of the Fishery

King mackerel, Spanish mackerel, and cobia are important target species of commercial, recreational, and for-hire fishermen throughout the Gulf and South Atlantic regions, particularly in South Florida. King mackerel and cobia are particularly important to the charterboat and offshore private boat fleets.

Most of the commercial fishery for king mackerel occurs in Florida, and most fish are taken in south Florida from November through March. A winter troll fishery takes place along the east and south coast, and a run-around gill net fishery occurs in the Florida Keys (Monroe County) during January. To address the potential for derby fishing, Florida attempted to allocate king mackerel catches among fishermen in different geographic areas by subquotas and landings (trip) limits. The Florida trip limit regulations were overturned in December 1992, by a federal court ruling, and the commercial quota was quickly taken in the Florida Keys with 900,000 pounds being landed there during a 10-day period in January, 1993.

A commercial hook-and-line fishery for king mackerel developed off Louisiana in the winter of the 1982-83 fishing season. This trolled-handline fishery was similar to the Florida hook-and-line fishery and was centered in the Grand Isle, Louisiana area. Due primarily to increased effort in the Western Zone, this winter fishery has not been operative since about 1990 because this area's allocation of TAC has typically been taken by the end of October. Additionally, this winter fishery included many catches of larger fish that in recent years have become less desirable or marketable. The current commercial fishery operates as both hook-and-line and gill net components off the west coast of Florida and hook-and-line only off Alabama, Mississippi, Louisiana, and Texas.

King mackerel have been a popular target for recreational fishermen, throughout the Gulf, for many years. Total recreational catches were relatively stable from about 1992 to 1997 at between 6.0 and 7.5 MP; however, catches in the last 3 years have dropped to around 4.0 to 5.2 MP (MSAP 2002) (Table 1). Recreational fishing for king mackerel is an important component of coastal economy in many areas, and it includes both direct and support industries.

Spanish mackerel have also historically been a popular commercially and recreationally targeted species, although not as important as king mackerel. Historically, the major harvest came from the commercial sector using gill nets in state waters of Florida. From 1987 to 1995 commercial landings ranged from approximately 4.0 MP to 6.0 MP; however, following the passage of a constitutional amendment banning gill nets in Florida state waters in 1995, catches declined significantly to approximately 2.5 MP. Catches have increased slightly in the last two years to approximately 4.0 MP (MSAP 2002) (Table 2); and with the prohibition of purse seines in 1987 and gill nets in Florida state waters in 1995, the gear used is primarily trolled hook and line.

Recreational catches of Spanish mackerel in the Gulf have remained rather steady since 1987 at around 2.0 MP despite actions of the Council to increase the bag limit from 3 fish in 1987 to 10 fish in 1992 and to 15 fish in 2000. This lack of change is primarily due to the lower popularity of Spanish mackerel as compared with king mackerel and other offshore stocks to recreational fishermen. Primarily because of the significant decrease in commercial catches, approximately two-thirds of the total catch has come from the recreational sector in recent years.

The fishery for cobia in the Gulf is primarily recreational with less than 15% of the total annual catch coming from the commercial sector (Table 3). Most fish are harvested from waters off the west coast of Florida. Commercial catches were up in the early to mid 1990s with catches

slightly over 225,000 pounds (Table 3). Landings have since declined to more historic levels. The fishery is almost exclusively hook and line and has been constrained by a 2-fish per person per day bag limit since 1990.

The recreational fishery for cobia has harvested a little over 1.0 MP annually in the last 3 years which is also below catches in the early to mid 1990s. The recreational fishery is also predominantly a hook and line fishery that has been constrained by a 2-fish per person per day bag and possession limit since 1990.

Current Status of the Fishery

The Gulf migratory groups of king and Spanish mackerel were determined to be overfished in the mid 1980s, and a rebuilding program of reduced allowable catches was implemented. Both stocks improved to a level that in 1995 the MSAP recommended that they no longer be considered as overfished. This conclusion was reinforced by Mace et al. (1996), wherein the overfished definition was recommended to be a 20% transitional SPR. The Gulf Council accepted this recommendation and included the change from a 30% transitional SPR to 20% transitional SPR in Amendment 8. The NMFS rejected this portion of Amendment 8 based on its determination of changes to the definitions of "overfished" in the Sustainable Fisheries Act (SFA); consequently, the overfished and overfishing definitions for Gulf group king and Spanish mackerel remained at 30% transitional and static SPR, respectively.

The last year that the Mackerel Stock Assessment Panel (MSAP) and the Council evaluated the status of the Gulf group king mackerel stocks using the aforementioned SPR parameters was in 2000 at which time the stock was determined to be overfished (transitional SPR estimated at 22%) but not overfishing (static SPR estimated at 33%). Ortiz et al. (2002) estimated these parameters under several model considerations, and all indicated that transitional SPR was still slightly less than 30% SPR. For the other mackerel stocks, the last full stock assessment occurred in 1998 wherein Atlantic group king mackerel and Gulf and Atlantic groups of Spanish mackerel were determined to be not overfished and not undergoing overfishing because all transitional and static SPR estimates were at or above 35%.

In accordance with NMFS guidelines developed as a result of the SFA amendment to the M-SFCMA, both the SAFMC and the Gulf Council submitted Generic SFA Amendments in 1999 that would change the definitions of overfishing and overfished and relate them to estimates of fishing mortality and biomass at MSY. To implement these changes, the NMFS suggested using a default control rule that specifies a MSST as a proxy for overfished and a maximum fishing mortality threshold (MFMT) as a proxy for overfishing. Subsequent stock assessments for Gulf group king mackerel in 2000, 2001, and 2002 have expressed the stock status based on these default control rule parameters. In 2000, there was only a 33% chance that $F_{1999/2000}$ was greater than MFMT and only a 35% chance that B_{2000} was less than B_{MSY}. In 2001, there was only a 10% chance that $F_{2000/01}$ was greater than MFMT and only a 20% chance that B_{2001} was less than B_{MSY}. The MSAP (2002) concluded that in 2002, there was only a 50% chance that $F_{2001/02}$ was greater than MFMT and only a 24% chance that B_{2002} was less than

B_{MSY}. Based on the default control rule status criteria and using a risk level of no more than a 50% probability that $F_{CURRENT}$>MFMT and $B_{CURRENT}$<MSST as recommended herein, the Gulf group king mackerel stock would not be considered as overfished or undergoing overfishing in any of the past three years. Furthermore, as discussed herein, it is questionable whether the stock was overfished based on these assessment criteria since approximately 1992. For the other mackerel stocks (Atlantic group king and Spanish mackerel and Gulf group Spanish mackerel) there is only a 0% to 1% chance that either overfishing or the overfished condition exist.

An assessment of cobia in 2001 concluded that there was only a 40% probability that F_{2000}>F_{MSY} (MFMT) and only a 30% probability that B_{2000}<MSST (defined as 70% of B_{MSY}). Consequently, under the proposed definitions herein, the cobia stock in the Gulf would not be considered as overfished or undergoing overfishing. MSAP (2001a) also concluded that the population appears to have increased since the early 1980s, probably because of the implementation of management measures in 1983 and 1990. These regulations appear to have contributed to increasing abundance and larger sizes in the catch which is dominated by the recreational sector with approximately 90% of the total landings.

IV. MANAGEMENT ALTERNATIVES AND REGULATORY IMPACT REVIEW

Introduction

The National Marine Fisheries Service (NMFS) requires a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. The RIR does three things: (1) it provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action, (2) it provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problem, and (3) it ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective way.

The RIR also serves as the basis for determining whether the proposed regulation is a "significant regulatory action" under certain criteria provided in Executive Order 12866, and provides some basic information in determining whether the proposed regulation would have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Act of 1980 (RFA).

This RIR analyzes the probable impacts that the alternatives in this regulatory amendment to the Coastal Migratory Pelagics Fishery Management Plan (FMP) would have on the commercial and recreational fisheries for Gulf group king and Spanish mackerel and cobia.

Problems and Objectives

The general problems and objectives are enumerated in the FMP, as amended, and the objectives are repeated in Section I, herein. The purpose and need for the present regulatory amendment are found in Section II of this document. Specifically, the current regulatory amendment addresses the following issues:

1. TAC for Gulf group king mackerel for the fishing year 2003-04.
2. Definitions of MSY, OY, the overfishing threshold, and the overfished condition for Gulf group king mackerel, Gulf group Spanish mackerel, and cobia

Description of the Fishery

A description of the fishery is found in Section III. A further description of the fishery, with particular emphasis on small business entities, is found in Section V.

Methodology and Framework for Analysis

Ideally, the expected present values of net yield streams over time associated with the different alternatives would be compared in evaluating impacts. Net yield streams in the present context mean producer and consumer surpluses in the commercial sector and angler-consumer surplus and for-hire vessel profits in the recreational sector of the Gulf group king and Spanish mackerel and cobia fisheries. Unfortunately, the necessary information to conduct this type of analysis is not available. So the approach taken is to describe and/or quantify the changes in short-term net benefits. This task is complemented by a mainly qualitative discussion of the long-term impacts. In this document, the "Socioeconomic Impacts" section comprises the bulk of the RIR.

HARVEST LEVELS

Action 1: TAC level for Gulf group king mackerel.

Alternative 1.A: Set TAC for Gulf group king mackerel at 9.8 MP, the mid-point of the ABC range under the $F_{30\%SPR}$ level of the combined Base 10 and CAA00 models.

Alternative 1.B: Set the TAC for Gulf group king mackerel at 7.0 MP, the mid-point of the ABC range under a $F_{40\%SPR}$ level of the combined Base 10 and CAA00 models.

Alternative 1.C: Set TAC for Gulf group king mackerel at 9.5 MP, the mid-point of the ABC range under the $F_{30\%SPR}$ level of the Base 10 model.

Alternative 1.D: Set the TAC for Gulf group king mackerel at 6.8 MP, the mid-point of the ABC range under a $F_{40\%SPR}$ level of the Base 10 model.

Alternative 1.E: Set the TAC for Gulf group king mackerel at 7.3 MP, the mid-point of the ABC range under a $F_{40\%SPR}$ level of the CAA00 model.

<u>Proposed Alternative 1.F</u>: Status Quo - Retain the TAC at 10.2 MP for Gulf group king mackerel which is also the mid-point of the ABC range under the $F_{30\%SPR}$ level of the CAA00 model.

<u>Discussion and Rationale</u>: Since 1981-82, catches of Gulf group king mackerel have ranged from a low of 3.0 MP in 1987-88 to a high of 12.3 MP in 1982-83 (MSAP 1997). Gulf group king mackerel catches consistently exceeded TAC from 1981-82 to 1997-98 when TAC was increased to 10.6 MP. From 1997-98 through 2000-01 catches have never reached TAC, primarily because of the increase in TAC from 7.8 to 10.6 MP. Furthermore, in the last two years, catches have been approximately 3.5 MP and 2.2 MP below TAC, respectively, and TAC was reduced from 10.6 MP in 1999-2000 to 10.2 MP in 2000-01. Finally, catches since 1992-93 have been relatively stable, probably because of stable bag limits for the recreational fishery that has an allocation of 68% of TAC (Table 1).

Despite overruns of the earlier TAC levels, the Gulf group king mackerel stock has recovered to biomass levels above the Council's proposed MSST level since at least 1999 (see Action 5 herein) and to F levels below the MFMT since 2000 (see Action 4 herein). The estimated ABC range using the currently approved $F_{30\%}$ static SPR has fluctuated in recent years; however, it has generally increased or remained about the same since 1996. The 1996 stock assessment determined that the ABC range was between 4.7 and 8.8 MP; however, the updated assessment in 1997 provided an estimate of between 6.0 and 13.7 MP. Although the updated assessment used primarily the same data as in 1996, an additional year showing good recruitment was the primary factor that caused the estimate of ABC to increase. The 1998 stock assessment calculated a range of ABC for Gulf group king mackerel between 7.1 and 10.8 MP. This range was slightly lower than the 1997 ABC range on which the Council voted to increase TAC from 7.8 MP to 10.6 MP in 1997-98. Although the range of ABC that was calculated in 1998 was somewhat narrower than in 1997, the midpoints were about the same, 8.9 MP and 8.7 MP, respectively, and both were significantly higher than the 6.8 MP midpoint in 1996. In 1999, the ABC range was more similar to the 1997 range although not as broad (8.0 to 12.5 MP). The 2000 stock assessment calculated a range of ABC for Gulf group king mackerel of 8.2 to 12.8 MP at the $F_{30\%SPR}$ target. This range was similar to the 1997 stock assessment recommendation of 6.0 to 13.7 MP, above the 1998 range of 7.1 to 10.8 MP, and almost identical to the 1999 range. The mid-point estimate of the ABC range was 10.2 MP. Transitional and static SPR estimates have shown an increasing trend since about 1994, with 2002 estimates at approximately 25% and 30%, respectively. Static SPR, which is the currently approved method used to determine whether the current fishing mortality rate will ultimately lead to a stock becoming overfished, increased from 21% in 1996-97 to 33% in 1998-99. The current estimate of static SPR at 30% is equal to the Council's approved definition of 30%, thus overfishing is not occurring. Transitional SPR, which is the method currently approved to determine if a stock is overfished has remained very steady at between 22% and 25% since 1996-97. Based on the new default control rule method for estimating status criteria as discussed and recommended herein, Gulf group king mackerel have not been overfished since at least the 1999 stock assessment. Because transitional SPR has been relatively stable since the early 1990s, it is

questionable whether this new method, if used in these earlier years, would have shown that the stock was overfished, at least since about 1990.

The estimates of recruitment (millions of fish age 1&2) using either the Base 10 model or the CAA00 model showed a decreasing trend from 1995 to 1998 followed by an increasing trend through 2000. Despite a 3-year down-tern in recruitment, spawning stock biomass in pounds has continued to increase since 1995 (Ortiz et al. 2002).

Since the 2000 stock assessment, the MSAP has looked at the status criteria for Gulf group king mackerel using a default control rule, as proposed by NMFS and partially included in the Council's Sustainable Fisheries Act Generic Amendment. This method is proposed herein as the Council's recommended procedure to define the overfishing threshold and the overfished condition for Gulf group king mackerel, as well as Gulf group Spanish mackerel and cobia. The MSAP (2000) stated that, "the evaluation of a stock under the (default) control rule is based on its status relative to B_{MSY} and the long-term fishing mortality rate associated with that spawning stock level, F_{MSY} or maximum fishing mortality threshold (MFMT). If the spawning stock size is greater than the minimum stock size threshold (MSST [1]), the stock is not overfished. Similarly, if the current fishing mortality rate (F) is less than MFMT or F_{MSY}, the fishery is not overfishing." The MSAP (2000) also stated that "the determination of whether the spawning stock size has fallen below MSST (whether or not the stock is overfished) will depend upon the acceptable level of risk chosen by the Council." Similarly, the determination of whether a stock is undergoing overfishing, i.e., the estimates of current F are greater than the MFMT (F_{MSY}), also depends on the level of risk that the Council believes is acceptable. The evaluation of a stock's condition is simplified by using ratios instead of actual values.
In viewing Gulf group king mackerel using this method, the MSAP (2000) noted that the majority (67%) of the ratios of F to F_{MSY} were below 1.0. Consequently, there would be only a 33% chance that the Gulf group king mackerel fishery would be undergoing overfishing at that time. Also, the majority of the estimates (65%) of spawning stock biomass (B) to B_{MSY} were above MSST. Consequently, there was only a 35% chance that the stock would have been considered overfished. The MSAP (2001b) showed that the chance of overfishing ($F_{2000\text{-}01}$>MFMT) was only approximately 10%, and the chance of the stock being overfished (B_{2001}<MSST) was only 20%.

The MSAP (2002) showed that the chance of overfishing ($F_{2001\text{-}02}$>MFMT) had increased to 50% based on a combination of changes to the stock assessment model runs. First, NMFS scientists determined that there was a systematic departure in model fit in the Texas Parks and Wildlife (TPWD) catch per unit effort (CPUE) index in all years prior to 1985. To resolve this discrepancy, the index was split into two indices, one from 1981 to 1985 and the other from 1985 through 2001. The results of these virtual population analysis (VPA) runs were called Base 10.

[1]The MSST is proposed to be specified as (1-M)*B_{MSY}, i.e. the spawning stock that can support MSY, but reduced by the natural mortality rate, M. Thus, in the case of Gulf group king mackerel, MSST is specified as 80% of the spawning stock that will support MSY.

Second, the catch-at-age data were revised to add 289 age samples from the 1995-97 period. When these updated ages were run with the Base 10 model, the results showed a significant movement of fish from older to younger ages. Therefore, the model showed an increased estimate of fishing mortality (F) due to a significant movement of fish from older to younger ages and a lower spawning stock size. Because of the drastic changes in the Base 10 model results from adding these few ages, a sensitivity analysis (CAA00) was run to estimate stock parameters, including ABC, using only the previous age structure from 2000. The MSAP (2002) could not reconcile why these changes should make such a drastic change in the estimated $F_{2001\text{-}02}$ when the B_{2001}, as opposed to B_{2002}, only changed from a 20% chance that the stock was overfished in 2001 to a 24% chance in 2002. The MSAP (2002) did not believe that the revised catch-at-age data could be completely discounted, but recommended that a more critical review be conducted. Since the changes, including where the additional age data came from, could not be adequately explained and neither the Base 10 nor CAA00 model was judged superior to the other, the MSAP (2002) evaluated stock status and estimated ABC at both $F_{30\%SPR}$ and $F_{40\%SPR}$ based on a combination of the two models. Using the combined Base 10 and CAA00 sensitivity runs, the MSAP (2002) concluded that the range of MSY was between 8.6 and 11.7 MP (20% and 80% confidence interval) with a midpoint of 10.7 MP, and the ABC for the MSY proxy $F_{30\%SPR}$ should not exceed 9.8 MP (Alternative 1.A). The OY range of ABC ($F_{40\%SPR}$) that was estimated by MSAP (2002) was between 5.3 and 9.6 MP (20% and 80% probability range) with a mid-point of 7.0 MP (Alternative 1B).

Because of the potential that the additional age data falsely biased the stock assessment toward smaller fish and a larger F value in 2001-02, an equally appropriate approach would be to not use any of the updated age information in estimating ABC at this time. In such a case, ABC could be estimated at either the $F_{30\%SPR}$ MSY range or the $F_{40\%SPR}$ OY range. The ABC was estimated at between 7.8 and 13.4 MP (10%/90% confidence interval) for the $F_{30\%SPR}$ range with a mid-point of 10.2 MP (Proposed Alternative 1F). At the $F_{40\%SPR}$ range, ABC was estimated at between 5.5 and 9.8 MP (10%/90% confidence interval) with a mid-point of 7.3 MP (Alternative 1.E) (Ortiz et al. 2002).

Under a previously recommended recovery scenario using the 30% transitional SPR as a recovery target (GMFMC 1998), the Gulf group king mackerel stock was expected to recover above this level by 2009, assuming a 10.6 MP TAC and only the average recruitment level for the 1987 to 1996 period. Because the Council is recommending use of the default control rule criteria to develop status determinations based on a 50% level of risk, no estimation of a recovery period was needed since under these criteria, the Gulf group king mackerel stock would not have been considered as overfished since at least 1999 (MSAP 1999, 2000, 2001b, 2002), and probably since approximately 1990 as previously discussed. Furthermore, spawning stock biomass has continued to increase under present and stable management conditions, including a TAC of 10.6 MP to 10.2 MP since 1997.

The Council's proposed action is to retain the present TAC at 10.2 MP (Proposed Alternative 1.F). This TAC level is equivalent to the mid-point of the estimated $F_{30\%SPR}$ ABC range under the stock assessment model that does not use the dubious additional age data (Ortiz et al. 2002).

Furthermore, it is equal to the yield under the Council's proposed OY definition of the yield associated with fishing at 85% of MSY when the stock is at equilibrium (Table 4). Although the stock is currently not considered to be at equilibrium based on the majority of the most recent model runs, as previously discussed recent years F values have been below F_{MSY} and biomass continues to increase. In fact, MSAP (2002) using the combination of model runs noted that over 21% of the runs showed that the stock was already at B_{MSY}, and as discussed under Action 4, any one of the 1,000 model runs could be the correct one. Consequently, the worst case scenario is that the stock size is approaching/transitioning toward the B_{MSY} level under the current management regime.

Based on the MSAP's (2002) decision to not totally discount the additional age data and to base their recommendations of ABC ranges using a combination of model runs with and without these data, a mid-point estimate of ABC of 9.8 MP was calculated for the MSY proxy of $F_{30\%SPR}$ (Alternative 1.A) (MSAP 2002). Although the 9.8 MP level is slightly below the current TAC, it is not significantly different from and is the lowest of the mid-point estimates of ABC for the MSY proxy of $F_{30\%SPR}$ calculated from 1999 to 2002 (10.1 MP, 10.2 MP, 11.1 MP and 9.8 MP, respectively), and it is within the range of the 20%-80% confidence interval range for the Council's proposed F_{OY} of 85% of F_{MSY} . Furthermore, since the Gulf group king mackerel stock would not be considered as overfished or undergoing overfishing based on the proposed status criteria, a TAC level in excess of the mid-point of the ABC range for OY is acceptable under 50 CFR Part 600.310 because catches are not meeting this level and the spawning stock biomass continues to increase. Retaining TAC at 10.2 MP should provide the least disruptive harvest level for the commercial sector of the fishery that is discussed further in the following sections, and it is consistent with the recommendations of the Council's Mackerel Advisory Panel (AP) and Socioeconomic Panel (SEP), and testimony from users.

A TAC of only 9.8 MP (Alternative 1.A) would likely result in a reduction in the commercial harvest of 128,000 pounds. The recreational harvest should not be effected by this choice of TAC because its allocation at this level has only been reached in 2 of the last 15 years. Alternatives 1.B, 1.D, and 1.E offer TACs of 7.0 MP, 6.8 MP, and 7.3 MP, respectively, and would impact the commercial fishery in approximately the same manner with harvest reductions of between 928,000 pounds and 1.09 million pounds. The recreational allocation would also have a high probability of being exceeded because catches have exceeded their allocation at these TAC levels in all years since 1992-93, except for 1999-00 and 2000-01. Under Alternative 1.D, a 6.8 MP TAC, the commercial allocation would be reduced by nearly 33% to only 2.175, and the recreational allocation would probably be exceeded under existing bag and minimum size limits. Alternatives 1.B, 1.D, and 1.E that would set TAC levels based on an OY proxy of $F_{40\%SPR}$ and would be considered draconian since the Gulf group king mackerel stock is not considered overfished or undergoing overfishing, and the stock has shown steady rebuilding since the early 1990's under present regulations and higher TAC and catch levels. Alternative 1.C that uses only the Base 10 model for the MSY proxy of $F_{30\%SPR}$ and an ABC midpoint of 9.5 MP also appears to not be representative of the best available scientific information because of the observed recovery of the stock at much higher catch levels over time and the previously discussed anomaly in the use of aging data.

Retaining the TAC at 10.2 MP would also be considered conservative and precautionary because the effects of regulations requiring bycatch reduction devices (BRDs) in shrimp trawls and the increase in the minimum size limit for Gulf group king mackerel from 20 inches to 24 inches FL that were approved in 1998 should reduce fishing mortality and help increase recruitment. The effects of these measures as well as consideration of release mortality have not been evaluated, and the majority of the fish affected by these regulations would only now be entering the fishery.

Biological Impacts: There should be no additional biological impacts from retaining the current TAC at 10.2 MP (Proposed Alternative 1.F); however, because most estimates indicate that the Gulf group king mackerel stock has not yet fully recovered to B_{MSY}, a lower TAC would be expected to expedite such recovery, if it is being met. Alternative 1.A (9.8 MP TAC) would probably not produce any additional biological benefits from status quo because catch levels under existing regulations have not produced this harvest. For the commercial sector a likely harvest reduction of 128,000 pounds would be expected; however, it would only represent approximately a 4% reduction in the commercial catch and a 1% reduction in total catch. Alternative 1.C would be expected to have similar impacts as Alternative 1.A, but slightly more adverse to the commercial sector. On the other hand, forgone catches from the recreational allocation have ranged from 1.4 MP to 2.7 MP in recent years or between 13.7% and 26.5% (MSAP 2002).

As previously discussed, TAC reductions as indicated in Alternatives 1.B, 1.D, and 1.E would probably have fairly significant reductions in catch for the commercial sector because this sector operates under a quota. Once an allocation is met, the fishery is closed. On the other hand, the recreational harvest is governed by bag and size limits, and its allocation is not monitored as a quota nor is the fishery closed. Consequently, recreational catches would not be affected by a TAC reduction alone. Because the recreational harvest would not be affected by a TAC reduction and it is allocated 68% of the annual TAC, a 33% reduction in TAC as with Alternative 1.D would only produce a 11% overall reduction, and a 28% reduction in TAC as with Alternative 1.E would only produce a 9.1% overall TAC reduction, both occurring from the commercial sector alone.

In summary, without additional constraints on the harvest by the recreational sector the more draconian reductions in TAC as indicated in Alternatives 1.B, 1.D, and 1.E would not produce an equivalent reduction in actual harvest. Furthermore, as previously discussed, such reductions do not appear to be necessary to effect recovery of the Gulf group king mackerel stock to B_{MSY} within a reasonable period of time, as well as continued recovery to B_{OY} because current catches are over 2.0 MP below the equilibrium yield at the Council's proposed OY proxy of $0.85*F_{MSY}$ (Table 4), and approximately 21% of the most recent model runs show that the stock has already recovered to B_{MSY}.

Socioeconomic Impacts: For any given TAC level for Gulf group king mackerel, the allocation of 68% recreational and 32% commercial filters the relative magnitude of effects of TAC changes on each sector. The actual effect of a TAC change, however, is determined at least by

two factors: (1) the specific regulatory regime governing each sector, and (2) each sector's harvest performance.

Gulf group king mackerel harvests of both sectors are currently subject to a minimum size limit of 24 inches FL. In addition, the recreational sector is subject to a 2-fish per person bag limit while the commercial sector is subject to vessel trip limits that vary by geographical area and gear type. Perhaps the more important regulation that determines the impacts of a TAC choice relates to the manner each sector's allocation is treated. The commercial allocation (inclusive of all sub-allocations) is considered a quota while the recreational allocation is not, thus fishery closures when an allocation is reached apply only to the commercial sector. Given the described regulatory regime, any TAC changes would potentially affect mainly the commercial sector over the short run, with the magnitude of effects being partly determined by the expected harvest for this sector. However, if TAC is exceeded in any one year, some additional restrictions may be imposed on both the commercial and recreational sectors in the succeeding years.

Table 1 shows some of the management and harvest characteristics of the Gulf group king mackerel fishery. For the period 1992/93-1996/97 when TAC was held at 7.8 MP, total landings averaged 9.63 MP annually, and every year landings exceeded TAC. For the three succeeding fishing years when TAC was raised and maintained at 10.6 MP, total landings averaged at 8.726 MP, which is about one million pounds below that of the previous period and the TAC. TAC for the 2000/2001 fishing season was reduced to 10.2 MP, with total landings for the period of 8.026 MP still falling well below the TAC. Thus, the last four fishing seasons registered total landings that fell well below the TAC. It is well worth noting that the major source of under-harvest of TAC has been the recreational sector. The commercial sector has maintained its landings at a relatively stable level, partly because of the quota closures that characterize this sector.

At the 7.8 MP TAC, the commercial sector exceeded its allocation by an annual average of 420,000 pounds while the recreational sector exceeded its allocation by an annual average of 1.37 MP. At the higher TAC of 10.6 MP for fishing years 1997-98 and 1998-99, the commercial sector continued to exceed its allocation by an average of 312,000 pounds while the recreational sector harvested below its allocation by an average of 1.24 MP. In succeeding fishing seasons (1999/2000 and 2000/2001), both the commercial and recreational sectors registered landings below their respective allocations.

Given the landings scenario depicted above, it is likely that if the more recent landings history were to continue into the near future, any reduction in TAC but not near or below 7.0 MP, would have no effect on the recreational sector even if the recreational allocation was considered a quota. This also implies that even if the recreational allocation continues to be considered not a quota, additional restrictions on the recreational sector may not be needed, if the only reason for those restrictions is to limit this sector to its allocation. A TAC at or below 7.0 MP can start to have impacts on the recreational sector, although with the current regime of no-quota closure, the recreational sector may not immediately experience any negative impacts. For the commercial

sector, any TAC change is likely to change the sector's harvest. If the TAC is increased, an increase in commercial landings may be expected as did happen when the TAC was raised from 7.8 MP to 10.6 MP. A decrease in TAC could also translate into lower landings, especially if quota overruns are reduced to a minimum or totally prevented. A TAC lower than the current TAC of 10.2 MP is likely to adversely impact the commercial sector. Although in more recent years, the commercial allocation has not been fully taken, the shortfall has been accounted mainly by one sub-area (Florida east coast). All other sub-areas consistently experienced quota closures. Any TAC and quota reduction then is bound to affect at least these other sub-areas. If the commercial quota is not effectively monitored, it can happen that an overrun of 300,000 to 400,000 pounds may occur as did happen in the fishing years 1992-93 to 1998-99 whether the TAC is increased or decreased. It is possible that larger overruns can happen if the TAC is substantially reduced.

One other consequence of a reduced Gulf group king mackerel TAC is that commercial vessels may redirect their effort to other fisheries, thereby putting more pressure on other stocks and the fishery dependent on those other fish stocks. Based on logbook information, there are about 600 vessels with commercial reef fish permits that consistently participate in the Gulf group king mackerel fishery. In the particular case of red snapper vessels holding Class I or Class II licenses, their harvests of king mackerel consistently account for 3/4 of the commercial Gulf group king mackerel quota in the Western Zone. If these vessels were prevented from harvesting their usual catch of king mackerel, they would have to expend more effort on red snapper and other reef fish to compensate for losses in the mackerel segment of their operations.

The following discussions on the economic implications of the various TAC alternatives make use of a similar approach employed by the Gulf Council's Socioeconomic Panel (SEP) in estimating the economic impacts of previous proposals to change the TAC for Gulf group king mackerel (SEP 2000). In the commercial sector, the price per pound of king mackerel is assumed to be $1.25. Producer surplus is considered to equal 20% of gross receipts under a TAC associated with $F_{30\%SPR}$ and 24% under a TAC associated with $F_{40\%SPR}$. The higher producer surplus under a higher SPR level reflects a relatively lower cost of fishing due to higher catchability under the higher SPR. The impacts on the recreational sector cannot be translated to economic values due to the absence of relevant information.

Proposed Alternative 1.F sets the TAC at its current level of 10.2 MP. In principle, there are no short-run impacts of this alternative. At any rate, potential implications of this alternative may be discussed. At the current 32/68 commercial/recreational allocation of TAC, this translates to 3.26 MP quota for the commercial sector, or an ex-vessel value of $4.08 million. Producer surplus, which is pegged at 20% of ex-vessel revenues, would amount to $816,000. The recreational allocation is 6.94 MP, which is well above the most recent recreational harvest of 4.951 MP. Although it is unknown whether recreational harvests will rebound or, if so, at what pace, at this time it is relatively safe to consider that the recreational allocation allowed by a 10.2 MP TAC exceeds that of current projected harvests. As such, no additional restrictions should be required in the short term to restrain the recreational sector to its allocation.

Alternative 1.A sets the TAC at 9.8 MP. This TAC still exceeds total annual landings in the last six years, but the commercial and recreational sectors may be affected in different ways. At this TAC, the commercial quota is 3.136 MP. This would be a reduction of 128,000 pounds from the status quo. This commercial quota reduction translates to $160,000 reduction in gross revenues or $32,000 in producer surplus. Although the overall commercial allocation is slightly above total commercial landings in the last two years, the under-harvest in the commercial sector is mainly accounted for by one sub-area in the east coast of Florida. All other sub-areas have experienced quota closures at the current and recent past TACs. It is then very likely that the estimated reduction in gross revenues and producer surplus may occur, even if overall commercial landings fall short of overall commercial quota. The recreational allocation under a 9.8 MP TAC is 6.664 MP. This allocation is higher than recreational landings in the last four years. It is unknown whether recreational harvests will rebound or, if so, at what pace, so that at this time it is relatively safe to consider the recreational allocation allowed by a 9.8 MP TAC would not exceed current projected harvests. As such, no additional restrictions should be required in the short term to restrain the recreational sector to its allocation.

Alternative 1.B sets the TAC at 7.0 MP. This TAC falls below most recent total landings so that there may be a need to impose more restrictive regulations to keep both the commercial and recreational sectors to their respective allocations. At this TAC, the commercial quota is 2.24 MP. Relative to status quo TAC, this alternative would reduce the commercial quota by 1.024 MP, or $1.28 million in ex-vessel revenues or $307,000 in producer surplus. At this low overall commercial quota, all sub-areas inclusive of the east coast of Florida are bound to experience quota closures. The recreational allocation under a 7.0 MP TAC is 4.76 MP. This allocation is slightly lower than the most recent recreational landings. At this TAC, some additional restrictive measures may have to be adopted to constrain the recreational sector to its allocation. This would be especially required if recreational effort and harvest rebound from their current low levels or if the stock biomass increases as should be expected from a more restrictive management measure, such as a low TAC.

Alternative 1.C sets the TAC at 9.5 MP. This TAC falls slightly below the level of Alternative 1.A. At this TAC, the commercial quota is 3.04 MP. Relative to status quo TAC, this alternative would reduce commercial quota by 224,000 pounds or $280,000 in ex-vessel revenues or $56,000 in producer surplus. Although the overall commercial allocation is slightly above total commercial landings in the last two years, the under-harvest in the commercial sector is mainly accounted for by one sub-area in the east coast of Florida. All other sub-areas have experienced quota closures at the current and recent past TACs. It is then very likely that the estimated reduction in gross revenues and producer surplus may occur, even if overall commercial landings fall short of overall commercial quota. The recreational allocation under a 9.5 MP TAC is 6.46 MP. This allocation is higher than recreational landings in the last four years. It is unknown whether recreational harvests will rebound or, if so, at what pace, so that at this time it is relatively safe to consider the recreational allocation allowed by a 9.5 MP TAC would not exceed current projected harvests. As such, no additional restrictions should be required in the short term to restrain the recreational sector to its allocation.

Alternative 1.D is the most restrictive TAC at 6.8 MP. This TAC is well below most recent total landings and below total landings extending way back as far the 1991/1992 fishing season. This TAC requires very restrictive regulations to keep both the commercial and recreational sectors to their respective allocations. At this TAC, the commercial quota is 2.176 MP. Relative to status quo TAC, this alternative would reduce the commercial quota by 1.088 MP, or $1.36 million in ex-vessel revenues or $326,000 in producer surplus. At this very low overall commercial quota, all sub-areas inclusive of the east coast of Florida are bound to experience quota closures. The recreational allocation under a 6.8 MP TAC is 4.624 MP. This allocation is well below most recent recreational landings, except in the 1999/2000 fishing year. At this low TAC, more restrictive measures would have to be adopted for the recreational sector. This would be especially required if recreational effort and harvest rebound from their current low levels or if the stock biomass increases as should be expected from a more restrictive management measure, such as a low TAC. If effort/harvest increases, the bag limit may have to be reduced possibly to 1-fish per person.

Alternative 1.E sets the TAC at 7.3 MP. This TAC slightly falls below most recent total landings so that there may be a need to impose more restrictive regulations to keep both the commercial and recreational sectors to their respective allocations. At this TAC, the commercial quota is 2.336 MP. Relative to status quo TAC, this alternative would reduce commercial quota by 928,000 pounds, or $1.16 million in ex-vessel revenues or $278,000 in producer surplus. At this low overall commercial quota, all sub-areas inclusive of the east coast of Florida are bound to experience quota closures. The recreational allocation under a 7.3 MP TAC is 4.964 MP. This allocation is slightly lower than the most recent recreational landings. At this TAC, some more restrictive measures may have to be adopted for the recreational sector. This would be especially required if recreational effort and harvest rebound from their current low levels or if the stock biomass increases as should be expected from a more restrictive management measure, such as a low TAC.

At this time, there exist few specific data with which to address short- and long-term social consequences of changes in TAC. Other studies of resource-dependent industries led the SEP (2000) to believe that as harvest restrictions increase, commercial fishermen and other stakeholders (marina owners, the for-hire sector, etc.) will be penalized proportionately, at least in the short run and perhaps in the long run. More restrictive TACs, such as those provided under Alternatives 1.B, 1.D and 1.E, also have the potential to seriously affect economic well-being, living conditions, and the immediate futures of people living in those communities that depend on the king mackerel fishery. However, without the necessary data, the magnitude of these effects cannot be estimated.

One other important consequence of a lower TAC on the commercial sector is the higher probability of an early closure which may be expected to become more acute as more fish become available. It may be recalled that the 1998-99 season experienced for the first time a closure of all segments of the commercial fishery, including the commercial fishery on the east coast of Florida. In previous years (and the latest one), this latter segment of the commercial fishery had remained open for the entire fishing season such that the closure experienced in the

most recent past year only validates the fact that overcapacity (relative to the quota) exists in the commercial Gulf group king mackerel fishery. A higher TAC (e.g., 10.2 MP) would have the opposite effects.

Among the various segments of the recreational sector, the for-hire industry would likely benefit more from an increase in TAC, and lose more from a reduction in TAC, mainly because this is the dominant player in the industry. In the past 5 years or so, the for-hire sector has registered the highest increase in catch on an annual basis. The only exception was in 1998 when this sector experienced a 13% decline in harvests relative to the preceding year. Industry representatives at the Council's Mackerel AP considered the unfavorable weather in the early part of the year as one major factor leading to the decline in harvests. In contrast, the private/rental mode registered a 57% increase in harvest in 1998 over that of 1997. If this pattern persists into the future, there exists a high likelihood that the private/rental mode would get most of the increase in recreational allocation if TAC were increased higher than 10.2 MP.

While TAC may be changed on an annual basis, each TAC choice has both short-term (as discussed above) and long-term implications. The long-term aspects of a TAC choice are determined by the future biological status of the stock under a chosen TAC and the type of management adopted for the fishery. On the biological side, the MSAP (2002) determined that Gulf group king mackerel is not overfished nor is it undergoing overfishing. Given this stock condition, maintaining the TAC at 10.2 may not jeopardize the long-term sustainability of the fishery. A lower TAC, on the other hand, may offer a higher likelihood of attaining and maintaining that long-term sustainability of the fishery, but at higher economic and social costs to the participants in the Gulf group king mackerel fishery. A much lower TAC, such as 6.8 MP, may in fact result in short-term losses that may not be outweighed by long-term gains considering that the MSY and OY levels, as currently proposed, would not be significantly higher than current TAC.

The type of management regime for the fishery in the future determines whether economic benefits from the fishery could be maintained or simply dissipated. The SEP (1999 and 2000) noted that if management continues with a permit moratorium and the setting of an annual TAC, short-run economic benefits from maintaining a higher TAC will be dissipated by increasing fishing effort by existing participants in the fishery, causing harvest costs to increase as the length of the fishing season continues to be abbreviated. The alternative of cutting TAC now would incur costs from lost production and redirect effort to other commercial and recreational fisheries, imposing costs on these other fisheries. Increases in TAC in the future would attract new effort into the commercial and recreational fisheries and result in increased operating costs. Intuitively, maintaining the TAC at its present level would minimize these costs under the present management institution. Unless the problem posed by an open access system of management is addressed, any benefits from the fishery at whatever TAC level would only be dissipated over time.

GULF GROUP KING MACKEREL

Action 2: MSY Alternatives

Proposed Alternative 2.A: Maximum Sustainable Yield (MSY) for Gulf group king mackerel is the yield associated with $F_{30\%SPR}$ when the stock is at equilibrium (currently estimated at 10.7 MP).

Alternative 2.B: MSY for Gulf group king mackerel is the yield associated with $F_{25\%\ SPR}$ when the stock is at equilibrium (currently estimated at 11.2 MP).

Alternative 2.C: MSY for Gulf group king mackerel is the yield associated with $F_{35\%\ SPR}$ when the stock is at equilibrium (currently estimated at 10.2 MP).

Alternative 2.D: MSY for Gulf group king mackerel is the yield associated with $F_{40\%\ SPR}$ when the stock is at equilibrium (currently estimated at 9.6 MP).

Alternative 2.E: Status quo - no action

Discussion and Rationale: MSY is defined as the largest long-term average catch or yield that could be taken from a stock or stock complex under prevailing ecological and environmental conditions. In Amendment 1 to the Coastal Migratory Pelagics FMP, MSY for Gulf group king mackerel was estimated at between 21.0 and 35.2 MP with a point estimate of 26.2 MP (GMFMC/SAFMC 1985). In 1999, MSY was estimated at between 10.8 and 13.8 MP (MSAP 1999). The most recent stock assessment using a range of models (Ortiz et al. 2002) estimated MSY at between 8.8 and 11.8 MP under 80% confidence intervals. A subsequent review by the Council's Mackerel Stock Assessment Panel (MSAP 2002) resulted in an additional model run that estimated MSY at between 8.6 and 11.7 MP. These estimates are based on using a proxy of yield associated with $F_{30\%SPR}$. In the Council's Generic Sustainable Fisheries Act Amendment, MSY for Gulf group king mackerel was set at 30% static SPR. This value was determined by the Council to be the most appropriate based on recommendations of the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP (1997). The NMFS rejected the Council's proposed 30% static SPR proxy definition of MSY, noting that SPR was based on a fishing mortality rate (F), whereas M-SFCMA and the National Standard Guidelines for National Standard 1 as promulgated under 50 CFR 600.310 require MSY to be specified in biomass units.

In readdressing the definition of MSY, the Council considered the aforementioned alternatives that are specified in terms of the yield associated with a F for a range of SPR percentages. The Council also considered the aforementioned recommendations of its stock assessment panels in selecting Proposed Alternative 2.A for MSY as the yield associated with $F_{30\%\ SPR}$ (currently estimated at between 8.6 and 11.7 MP). The Council believed that alternatives using higher SPR levels (Alternatives 2.C and 2.D) would result in underestimating MSY that could result in

an erroneous decision to establish more restrictive management measures and may not result in optimizing yield from the fishery which is the management target required by the M-SFCMA. Furthermore, the use of a lower SPR level (Alternative 2.B) was determined to overestimate MSY which could lead to overfishing if the associated F is maintained.

Biological Impacts: The setting of an MSY level of itself would not cause any biological impacts; however, management measures that would be required to maintain harvests of Gulf group king mackerel at or below this level would produce biological impacts. Consequently, the biological impacts of the aforementioned alternatives would be indirect. Furthermore, the impacts could be positive or negative depending on the level of risk that is acceptable. All the alternatives listed except Alternative 2.B should provide a risk-averse yield that would allow a sufficient spawning stock size to prevent overfishing. Alternative 2.B is the most liberal of the MSY estimates (high MSY and F_{MSY}, and low B_{MSY}). It would allow the greatest yield to be taken, but at a higher risk of long-term overfishing if the estimates are incorrect. Alternative 2.D is the most precautionary with the lowest associated F value and the highest associated spawning stock biomass. The Proposed Alternative 2.A and Alternative 2.C are median MSY proxies with Alternative 2.C affording only slightly less risk. The Proposed Alternative 2.A is consistent with the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP Reports since 1997. Fishing at or below this recommended level ($F_{30\% SPR}$) allows for the fishery to achieve the maximum long-term yield while maintaining sufficient stock size that such yields can be perpetuated with little risk of overfishing. Although MSY is currently not specifically defined, the current targeted management yield is based on a 30% static SPR. Consequently, Alternative 2.E (no action) would provide the same F projections and yield projections within an ABC range as the Proposed Alternative 2.A. However, based on previous rejections of the use of SPR as a proxy for MSY by NMFS, it is questionable whether the status quo alternative is approvable. In terms of biological impacts, they should be no different from the Proposed Alternative 2.A.

Socioeconomic Impacts: The setting of MSY, F_{MSY}, and SS_{MSY} parameters does not by itself create direct socioeconomic impacts. However, it affects the determination of OY targets, MSST, and MFMT and thus the setting of harvest levels and associated management measures. Overly conservative parameters could lead to more restrictive regulation than what is necessary to maintain the stock at sustainable levels over the long term. That, in turn, would result in unnecessary socioeconomic hardship. Conversely, selecting parameters that are not appropriately cautious could result in regulations that provide for an increased yield in the short term. But those regulations could result in a reduced yield over the long term if MSY is overestimated. One major issue, then, associated with the choice of MSY is the balancing of conservation measures with associated socioeconomic impacts. To provide some general insights into this issue, it is instructive to compare the various MSY levels with historical harvests but with some limitations noted below.

At present, the yield equivalent of MSY associated with each of the alternatives are: 11.2 MP at $F_{25\%SPR}$; 10.7 MP at $F_{30\%SPR}$; 10.2 MP at $F_{35\%SPR}$; and, 9.6 MP at $F_{40\%SPR}$. As expected, the higher the SPR level, the lower are the associated F and numerical values for MSY. The reverse

occurs with respect to spawning biomass, that is, a higher biomass is associated with a higher SPR. The TAC for Gulf group king mackerel has been gradually increased over the years, with the exception of the 2000/2001 season when the TAC was decreased from 10.6 MP to 10.2 MP. Combined commercial and recreational landings consistently exceeded the TAC in the past, but since the 1997/1998 season when TAC was increased from 7.8 MP to 10.6 MP landings have fallen short of the TAC. Although both the commercial and recreational sectors have contributed to over- and under-harvest of TACs, the recreational sector by far has been the major factor. In the most recent years, commercial landings have remained relatively stable at around the sector's quota while recreational landings have fallen well below the sector's allocation.

The highest recorded total landings since the 1986/1987 season stood at 10.85 MP in 1994/1995, followed by 10.08 MP in 1997/1998, and 9.8 MP in 1996/1997. Among the choices for MSY, only Alternative 2.D, with an estimated yield of 9.6 MP, would require a long-term target yield that falls below historical landings. It should be noted, however, that more recent landings are still below this MSY alternative. In this regard, the MSY alternatives, with the possible exception of Alternative 2.D, offer some potential for revenues and profits to the commercial sector and for-hire vessels to increase in the future. Consumer surplus to recreational anglers may also increase with the potential to harvest more and possibly larger sized fish. With the expansion at the harvest level, social and economic benefits may also ripple through the other market levels and support industries. The one important issue to note here is that the performance of the recreational sector is currently influenced by some factors other than higher TACs so that the future benefits to this sector could hinge on changes in factors that currently limit the ability of the sector to harvest its entire allocation.

If all MSY alternatives have equal probability of promoting the long-term sustainability of the stock, then the one that offers higher potential social and economic benefits may be ranked higher than those that provide lower benefits. In the absence of estimates of the social and economic benefits derived from any of the MSY alternatives, it may only be assumed that higher benefits would be with a higher MSY. In this regard, Alternative 2.B would be ranked highest and Alternative 2.D lowest. Proposed Alternative 2.A may be ranked second among the MSY alternatives. If the no action alternative were interpreted to be associated with MSY level equivalent to that of Proposed Alternative 2.A, then this alternative may also be ranked second overall. However, as noted above, questions have been raised regarding the appropriateness of the no action alternative for MSY specification.

In the absence of information on probabilities, one may only consider the qualitative chance of each alternative in promoting the long-term sustainability of the stock. A fishing mortality rate associated with a higher SPR level probably has a higher probability of maintaining the stock's long-term sustainability than one associated with a lower SPR. In this sense, Alternative 2.D may be considered to offer a better chance of maintaining the stock's long-term sustainability than others. However, the associated MSY level of Alternative 2.D is lower than those of others implying that the alternative's long-term socioeconomic benefits would also be lower. A better balance of stock conservation and socioeconomic benefits is preferred by either Proposed

Alternative 2.A or Alternative 2.C. These two alternatives, then, may be ranked higher than the other alternatives for MSY.

The foregoing discussion of the socioeconomic impacts of the various MSY alternatives was undertaken from a long-term perspective. However, some reference to short-term conditions were also made, and the basic conclusion from this perspective is that none of the MSY alternatives imply a total allowable catch that is lower than recent or reasonably foreseeable harvests. Therefore, no economic or social impacts are expected as current harvest operations are accommodated.

Action 3: OY Alternatives

Alternative 3.A : Optimum Yield (OY) for Gulf group king mackerel is the yield associated with $F_{40\% \text{ SPR}}$ when the stock is at equilibrium (currently estimated at 9.6 MP).

Alternative 3.B: OY for Gulf group king mackerel is the yield associated with $F_{35\%SPR}$ when the stock is at equilibrium (currently estimated at 10.2 MP).

Alternative 3.C: OY for Gulf group king mackerel is the yield associated with $F_{30\%SPR}$ when the stock is at equilibrium (currently estimated at 10.7 MP).

Alternative 3.D: OY for Gulf group king mackerel is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.65*F_{MSY}$ when the stock is at equilibrium (currently estimated at 9.3 MP).

Alternative 3.E: OY for Gulf group king mackerel is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.75*F_{MSY}$ when the stock is at equilibrium (currently estimated at 9.8 MP).

Proposed Alternative 3.F: OY for Gulf group king mackerel is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.85*F_{MSY}$ when the stock is at equilibrium (currently estimated at 10.2 MP).

Alternative 3.G: OY for Gulf group king mackerel is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.90*F_{MSY}$ when the stock is at equilibrium (currently estimated at 10.4 MP).

Alternative 3.H: Status quo - retain current OY statement.

Discussion and Rationale: National Standard 1 of the M-SFCMA requires that stocks be managed to produce OY on a continuing basis, and the subsequent guidelines for National Standard 1 (50 CFR Part 600.310) provide guidance to the councils in setting OY. This

guidance relates that OY is the amount of fish that will provide the greatest overall benefit to the Nation with respect to food production and recreational opportunities and is prescribed on the basis of MSY as it may be reduced by any relevant social, economic, or ecological factor. The guidelines go on to say that OY may be expressed as a formula that converts periodic stock assessment data into annual target harvest levels that cannot exceed, but may be equal to, MSY target levels. The guidelines continue to note that the Councils should adopt a precautionary approach and set OY levels safely below limit reference points in order that they are "explicitly" risk averse. Although OY target levels may be exceeded, continual harvest above the OY target would result in a determination of overfishing. Restrepo et al. (1998), in developing NMFS' technical guidance in setting an OY level, suggested that OY should be set at a yield where the fishing mortality rate is 25% below the MSY, limit fishing mortality rate (i.e., 0.75 * F_{MSY}). They surmised that setting F at this level would result in only a 20-30% probability of exceeding the MFMT. Furthermore, by reducing F, the stock size is allowed to increase. Restrepo et al. (1998) estimated that fishing at 0.75 * F_{MSY} would allow a stock to build to 125-131% of B_{MSY}; and the reduction in yield is only about 6% of MSY.

Table 4 shows the various reductions in yield for the OY benchmark alternatives presented. As shown for Gulf group king mackerel, the Proposed Alternative 3.F (the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.85*F_{MSY}$ when the stock is at equilibrium) results in a yield relative to the F_{MSY} yield of 95%, whereas Alternative 3.E (the yield associated with 0.75 * $F_{MSY)}$ (guidance from NMFS) results in a yield of 91% of the $F_{30\%SPR}$ proxy for F_{MSY} yield. Thus, the Proposed Alternative 3.F is only slightly less conservative than the NMFS recommendation, and the reduction in yield (95%) is closer to that envisioned by Restrepo et al. (1998) as stated above. Alternatives 3.D which results in a yield of only 87% of the $F_{30\%SPR}$ yield and Alternative 3.A which results in a yield of 89% of the $F_{30\%SPR}$ yield are also slightly more risk-adverse. Alternative 3.C is the least conservative an would result in yields equal to the $F_{30\%SPR}$ yield. The Proposed Alternative 3.F and Alternative 3.B offer approximately the same equilibrium yield; whereas Alternative 3.G would be more risk prone and result in potential yields that are very near the $F_{30\%SPR}$ yield (97%). As with the MSY alternatives, Alternative 3.H (status quo) is probably not a viable or advisable alternative for 2 reasons. First, it is stated in terms of SPR (30% SPR) which has previously been rejected by the NMFS. Second, it is stated as being equal to MSY which as previously discussed is the least conservative alternative for OY. Although not the most conservative of the alternatives presented, the Proposed Alternative 3.F is only slightly less conservative than the recommendations under NMFS' technical guidance (Restrepo et al. 1998). It offers sufficient protection (5% below MSY) and a cushion of SSB that will prevent overfishing from occurring and allows for maintenance of the existing TAC within the ABC range at this OY level. Because OY is defined in terms of a yield at 85% of the yield at F_{MSY}, it will be re-evaluated in accordance with the National Standard 1 Guidelines at each stock assessment (currently scheduled for 2004), thus providing even further protection against overfishing.

Biological Impacts: As with setting definitions of MSY, setting an OY yield definition would not of itself cause any biological impacts; however, management measures that would be required to keep the harvest of Gulf group king mackerel at a given level over the long-term would produce

biological impacts. The severity of the impacts, either positive or negative, would also vary based on the aforementioned alternatives because of the relative degree of conservatism that each has. Alternative 3.C is the least conservative, would result in the highest ABC range, and would potentially allow the highest annual catches depending on the TAC selected from within the range. On the other hand, Alternative 3.D is the most conservative and would result in the lowest ABC range with probably the lowest TAC and catch levels. Alternative 3.A would provide approximately the same level of conservatism as Alternative 3.D. Consequently, Alternative 3.C would incorporate the greatest level of risk that the stock would incur overfishing and potentially become overfished, and Alternatives 3.D and 3.A would provide the greatest level of protection against overfishing (Table 2). None of these 3 alternatives is likely to meet the M-SFCMA definition of "optimum" with respect to yield or the National Standard 1 Guidelines of providing the greatest overall benefit to the Nation. Although potentially providing for the greatest level of harvest, Alternative 3.C would also incorporate the greatest jeopardy of overfishing and the potential for the stock to become overfished. If such conditions occurred, more stringent management measures than would be required under Alternative 3.D may be needed in order to end overfishing or to recover the stock from an overfished state. Conversely, Alternatives 3.D and 3.A probably provide too great a level of conservatism and would force setting of TAC levels that would not provide participants with optimal access to the resource. The Proposed Alternative 3.F and Alternative 3.B offer the same yield at 95% of F_{MSY} while Alternative 3.E is slightly more conservative (Table 4).

The Proposed Alternative 3.F and Alternative 3.B are considered to be "middle-of-the-road" in terms of the level of risk. Consequently, either would probably best fit the definition of OY by offering the greatest benefits to the fishery with about the same potential of biological impacts through a reduction in harvest below MSY. Based on the present condition and trends in the Gulf group king mackerel stock, the biological risks associated with either of these alternatives would appear to be minimal, and the current TAC is supported by this definition. Fishing at or below the estimated yield level under the Proposed Alternative 3.F would allow for the fishery to achieve the optimum long-term yield while maintaining sufficient stock size that such yields, and potentially larger catches, can be perpetuated. The current OY target level is 30% static SPR. Because the NMFS rejected the revised OY definition in the Council's Generic SFA Amendment to 40% static SPR based on the fact that it was not specified in terms of biomass, it is doubtful that Alternative 3.H (status quo) would be approved. Furthermore, the status quo option would provide the same F projections and yield projections within a F_{MSY} ABC range and would be more risk-prone than the Proposed Alternative 3.F. In terms of biological impacts, Alternative 3.H would equal to Alternative 3.C.

Socioeconomic Impacts: As currently worded, the specification of OY under each alternative is based mainly on biological (or perhaps ecological) considerations. Absent then is the consideration of a process that would lead to the maximization of net social and economic benefits to the nation from a given harvest yield bounded upward by MSY. From a purely economic standpoint, the process may be described as moving from MSY to a lower level such that net economic benefits from the king mackerel fishery are maximized. This lower level is termed maximum economic yield (MEY). However, achieving MEY is generally embedded in

the management regime adopted. A management regime that reduces effort in the fishery, such as an Individual Fishing Quota (IFQ) program, offers a higher likelihood of achieving MEY than other management regimes. When other than purely economic factors, such as the employment, historical and cultural importance of a fishery to certain communities, are also considered in the determination of OY, the associated harvest level would be different from MEY. For example, if employment promotion is introduced into the process of determining OY, the resulting harvest level may be higher than MEY but as prescribed by the M-SFCMA should not exceed MSY. As with MEY, a management regime would have to be developed to insure that a certain specified level of employment is achieved. Should MEY or another yield associated with achievement of other social goals (e.g. employment) equal one of the OY alternatives, such occurrence is mainly accidental.

Given the foregoing discussion, the ability to describe the socioeconomic implications of the various OY alternatives is reduced to describing the socioeconomic status of the fishery at various harvest levels associated with each choice of OY.

In general, the higher the allowable yield, the better would be the socioeconomic outcome. But this outcome has to be modified by the long-term sustainability of the stock at a chosen OY and the type of management regime adopted for the fishery. Among the alternatives, Alternative 3.A is one of the more conservative from a biological standpoint. It would result in a smaller but also more stable yield. It would also have one of the lowest likelihoods (only Alternative 3.D is lower) that a recovered stock biomass would drop below MSST forcing a recovery plan. All the other alternatives would allow a greater harvest, but also have a greater risk of the stock biomass dropping below MSST. Alternative 3.H (no action) offers certain perspectives that are different from the other alternatives. Although, as previously discussed, the no action alternative may be considered to provide a harvest level similar to that of Alternative 3.A, it does not provide an explicit specification of OY. It is the implication of this latter aspect of the no action alternative that will be elaborated below.

The yield equivalent of OY ranges from 9.3 MP under Alternative 3.D to 10.7 MP under Alternative 3.C, with OY being set at 10.2 MP under Proposed Alternative 3.F. Relative to more recent harvest performance in the Gulf group king mackerel fishery, all OY alternatives may not result in requiring short-term harvest reductions. However, the highest total landings in the last 5 years stood at 10.08 MP, so that if effort especially in the recreational sector picks up, selection of OY below this harvest level can result in negative socioeconomic impacts on fishery participants. As with the choice for MSY, a balance between socioeconomic impacts and long-term sustainability of the king mackerel stocks needs to be achieved. If all OY levels have equal probability of maintaining the long-term sustainability of the stock, the preferred choice should be the alternative that can provide the highest socioeconomic benefits. This perhaps can be approximated by an alternative that provides for the highest OY level, i.e., Alternative 3.C. Considering the fact that such probability is likely to vary from alternative to alternative, with the highest (lowest) OY level likely to be associated with the least (highest) probability of maintaining the long-term sustainability of the stock, the likely best alternative would be between the extremes of Alternative 3.C and Alternative 3.D.

The Council's preferred alternative for OY (Proposed Alternative 3.F) is currently estimated to have an equivalent long-term yield of 10.2 MP, which is equal to the current (and proposed) TAC. The biological implications of this OY choice have been discussed above. From an economic standpoint, this choice implies that fishery participants have basically nothing to look forward to in terms of possible harvest improvement in the fishery. But at the same time, this choice also means that current regulations need not be changed. This consideration, in turn, brings out the issue of whether current regulatory regime provides the best economic environment for fishery participants. In the short-term, it is possible to enhance the economic outcome by relaxing regulations, since both the commercial and recreational sectors are not fully harvesting their allocations. However, it could result in overshooting the quota if effort, particularly in the recreational sector, picks up. This could have destabilizing effect on the fishery as more stringent regulations would have to be imposed to control harvests. It thus appears more beneficial to maintain current regulations over the short-term to provide stability in the fishery. Over the long-term, the economic status of the fishery may be improved if at least in the commercial sector some form of controlled access system is adopted. This may be the appropriate approach to provide the fishery more flexibility in harvesting Gulf group king mackerel than what is provided by the current regime of allocating the commercial quota to various geographic areas.

In terms of providing no specific OY level, the no action alternative may be interpreted in two ways. First, OY is not currently specified but would be set after the stock is fully recovered or when it is nearing full recovery. In this case, the possibility exists that socioeconomic information may be available as to be explicitly included in the specification of OY. Second, a specific OY would not be set even when the stock is fully recovered but would be simply stated as any harvest within the specified MSY. Under an open access system, OY would likely be equal to MSY, provided total harvest is effectively controlled not to exceed MSY. But under a controlled access system, particularly of the individual fishing quota (IFQ) type, OY (at least from an economic perspective) would fall below MSY.

A biological specification of OY is instructive in terms of at least knowing the yield target of managing the fishery, but specifying management solely on the basis of a biological definition of OY may not trace a path that provides the best socioeconomic results. For example, open access management measures may force the fishery to produce at the biologically specified OY, but the economic status of the fishery may be worse off than that achieved under a controlled access type of management even at lower yield levels. Unless then in this particular example, an OY is specified, implicitly or explicitly, with accompanying general management approach that would allow the fishery to be economically efficient, none of the alternatives may be considered superior over any other alternatives. If social factors are also considered, then another OY will have to be specified, with an accompanying general management approach that would allow the fishery to achieve those social goals.

Although each OY alternative is specified mainly on biological grounds, socioeconomic factors can be influenced by the selection of a specific OY. As noted earlier, each OY alternative is

associated with a different harvest level such that choosing one alternative over another would yield its own unique socioeconomic consequences. It is in this nature that socioeconomic factors are considered in the Council's choice of OY. One other issue to note here is that the alternative specifications of OY will accommodate current and reasonably foreseeable harvest, and therefore no economic or social impacts are expected as current operations are accommodated.

Action 4: Overfishing Threshold Alternatives (MFMT)

> **Proposed Alternative 4.A: Set MFMT = $F_{30\%SPR}$ = F_{MSY}. The Gulf group king mackerel stock would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 50%.**
>
> **Alternative 4.B: Set MFMT = $F_{30\%SPR}$ = F_{MSY}. The Gulf group king mackerel stock would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 40%.**
>
> **Alternative 4.C: Set MFMT = $F_{30\%SPR}$ = F_{MSY}. The Gulf group king mackerel stock would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 30%.**
>
> **Alternative 4.D: Set MFMT for the Gulf group king mackerel stock at a fishing mortality rate equivalent to 25% static SPR ($F_{25\%SPR}$).**
>
> **Alternative 4.E: Set MFMT for the Gulf group king mackerel at a fishing mortality rate equivalent to 35% static SPR ($F_{35\%SPR}$).**
>
> **Alternative 4.F: Status Quo - the MFMT for the Gulf group king mackerel is a fishing mortality rate equivalent to 30% static SPR ($F_{30\%SPR}$).**

Discussion and Rationale: The Sustainable Fisheries Act requires Councils to manage fishery resources to achieve MSY as a upper limit to OY. The National Standard Guidelines (50 CFR 600.310) also require that each FMP must specify status determination criteria for each stock or stock complex under a FMP, and such criteria must be objective and measurable to the extent possible. These status criteria are specified for determining the overfishing threshold (MFMT) as the upper limit to the fishing mortality rate (F) and the overfished threshold (MSST) as the lower limit to the spawning stock biomass or other measure of reproductive capacity. The MFMT is the level or rate of fishing mortality that, if exceeded, will result in overfishing and jeopardize the capacity of a stock to produce MSY on a continuing basis. The National Standard Guidelines (50 CFR 600.310) also require the Council to submit a plan to end overfishing if the MFMT level is being exceeded. In the Council's Generic Sustainable Fisheries Act Amendment, the Council proposed, and NMFS approved, a MFMT definition for Gulf group king mackerel as: "a fishing mortality rate equivalent to 30% static SPR ($F_{30\%SPR}$)." The MSAP (1999) noted that projecting $F_{30\%}$ to attain MSY estimates depends upon future recruitment; consequently, calculations of the range of MSY and ABC have subsequently been conducted using average recruitment estimates in the FADAPT VPA bootstraps. Action 4 reviews the

appropriateness of the currently approved Alternative 4.F as opposed to other alternatives for MFMT.

Alternatives 4.D, 4.E, and 4.F were evaluated in the course of developing the Generic Sustainable Fisheries Act Amendment. Alternative 4.F (Status Quo - $F_{30\%SPR}$) was determined to be the most appropriate based on the biology of Gulf group king mackerel as discussed below and in the discussions and recommendations of the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP (1997). Furthermore, as discussed in the Generic Sustainable Fisheries Act Amendment, use of a higher SPR as in Alternative 4.E would likely overestimate MFMT and result in a more restrictive management regime than is needed to optimize yield. Also, a lower SPR, as in Alternative 4.D could result in a higher MFMT and increase the risk of overfishing.

The Proposed Alternative 4.A and Alternatives 4.B and 4.C all utilize the recommended $F_{30\%SPR}$; the only difference is in the level of risk associated with each alternative. This level of risk comes from the bootstraping procedure of the VPA analysis that uses 500 simulations of $F_{CURRENT}$/MFMT to develop a percentage of simulations that may be either above or below the MFMT, designated by this slate of alternatives as $F_{30\%SPR} = F_{MSY}$. Because any one of the 500 bootstraps could correspond to the correct $F_{CURRENT}/F_{30\%SPR}$ value, the 50% probability (Proposed Alternative 4.A) is in essence a point estimate, or the best scientific evaluation of $F_{CURRENT}/F_{30\%SPR}$. Alternatives 4.B and 4.C would provide more risk-averse definitions of the overfishing threshold; however, they are arbitrary and potentially erroneous. Furthermore, the more conservative 30% and 40% probabilities (Alternatives 4.C and 4.B, respectively) for MFMT could lead to management measures to reduce catch that would not maximize benefits to the Nation. Finally, as explained in MSAP (2002), minor, unexplained changes to the stock assessment input data can cause major changes in the outcomes. As shown in MSAP (2001b) there was only a 10% probability that $F_{2000-01}$>MFMT ($F_{30\%SPR}$) . However, in 2002 with no changes to the management regime and only minor changes to overall catch, the addition of only 289 age samples to the 27,000+ database caused an unexplained skewing of the catch-at-age data. This change resulted in the assessment showing more younger fish in the population and higher F values relative to $F_{30\%SPR}$. Consequently, the probability of $F_{2001-02}>F_{30\%SPR}$ changed from 10% to 50%. Such an annual shift would probably not reflect reality; however, if less than a 50% probability definition were used, a determination of overfishing would likely ensue, and possibly additional management measures, before further evaluation of the reasons for the unlikely change could be attempted.

Biological Impacts: As previously noted for MSY and OY definitions, the setting of a definition of the overfishing threshold (MFMT) would not result in either positive or negative biological impacts; however, management measures that would be required to keep F values at or below $F_{30\%SPR}$ or other proxy for MFMT would have biological implications. Using various analyses, Ortiz et al. (2002) estimated $F_{MSY} = F_{30\%SPR}$ for 2001-02 at between 0.24 and 0.26. Table 4 shows that $F_{30\%SPR}$ when the stock is at equilibrium is approximately 0.25, and equilibrium yield is approximately 10.7 MP. Figure 4 of MSAP (2000) shows that annual F estimates have been very consistent since about 1989-90 at slightly above to slightly below 0.2. MSAP (2002)

reported that spawning stock biomass has steadily increased over the same period, and, as previously discussed, catches have been below the current TAC of 10.2 MP. Consequently, and considering other factors such as recruitment and bycatch reduction, it is highly plausible that F values have been at or below $F_{30\%SPR}$ since approximately 1990. Thus, it is reasonable to conclude that $F_{30\%SPR}$ is the most biologically defensible proxy for MFMT (overfishing threshold).

As previously discussed, the Proposed Alternative 4.A is the most scientifically defensible and is equal in its potential biological impacts to those of Alternative 4.F which is status quo and has been used as the overfishing definition for many years, with the exception that it establishes an acceptable risk probability. Alternatives 4.B and 4.C are only slightly more risk-averse than Proposed Alternative 4.A because as previously stated the probabilities fluctuated from 10% to 50% in one year with no change in management measures and very little increases in catch (MSAP 2001b, 2002). Alternative 4.E is more risk averse, but completely arbitrary and not supported by previous scientific advice. Furthermore, based on the history of management for Gulf group king mackerel, this additional precaution in not necessary.

To summarize, the stock was considered to be overfished with the inception of the Coastal Migratory Pelagics FMP in 1985 and not fully recovered until approximately 1999 with the establishment of the proposed default control rule method of assessing status criteria (overfishing and overfished conditions). Throughout most of this period (1986 to 1999) the stock was managed using overfishing criteria specified as either 20% SPR or 30% SPR, and annual TAC levels were implemented based on the 16^{th} and 84^{th} percentile ranges (one standard deviation) of ABC. Also, throughout most of this period, TAC levels were set at the upper end of this range where scientific advice said that there was only a 16% chance of not incurring overfishing. Additionally, actual catches from 1986-87 to 1996-97 consistently exceeded these TAC levels, sometimes by nearly 100% (Table 1). Despite the large annual overruns and the risk-prone TAC levels, the spawning stock biomass steadily increased using $F_{30\%SPR}$ in recent years and in earlier years $F_{20\%SPR}$ as the overfishing threshold upon which ABC ranges and TAC levels were set. Based on this history of management, Alternative 4.D may be determined to provide an adequate overfishing threshold; however, it would be more risk-prone and is not recommended by the Council's scientific advisory panels as previously discussed.

Socioeconomic Impacts: MFMT is basically a biological concept, but it does provide the tone for setting management measures that have implications on both the stock and its exploitation by various user groups. If current fishing mortality exceeds the chosen threshold for a given probability, the stock would be considered to be undergoing overfishing, and regulatory measures have to be implemented to arrest overfishing. Proposed Alternative 4.A, Alternative 4.B and Alternative 4.C differ only in the choice of probability level. As may be expected, the lower the probability criterion, the higher is the likelihood for the stock to be declared as undergoing overfishing. As per results of the most recent stock assessment, the lower probability levels of 30% and 40% would result in Gulf group king mackerel being considered as undergoing overfishing, and potentially more restrictive regulations would be adopted. Considering, however, the relatively low landings in more recent years, adoption of more

restrictive regulations may not be binding unless they are designed to be extremely restrictive. It appears that at present the adoption of more restrictive regulations would only reduce socioeconomic benefits that may not be totally outweighed by benefit increases in the future. If effort picks up in the future, the 50% probability level may be exceeded, but only then would more restrictive regulations be adopted. In a sense, the 50% probability level minimizes the adoption of restrictive regulations but perhaps provides adequate warning system for adoption of such regulations in the future.

Alternatives 4.D, 4.E, and 4.F respectively provide for lower, higher and equal fishing mortality threshold as the other alternatives, but without the probability criterion. These alternatives have similar socioeconomic implications as the other alternatives, but the resulting regulatory measures if the threshold is exceeded may be more restrictive. For example, Alternative 4.D may require more restrictive measures than Alternative 4.C even though the latter appears to be a more restrictive threshold in the event that the estimated probability of current F to exceed the threshold under Alternative 4.D is significantly lower than 30%.

Action 5: Overfished Threshold Alternatives (MSST)

Proposed Alternative 5.A: Set the minimum stock size threshold (MSST) at (1-M)*B_{MSY} or 80% of B_{MSY}. Gulf group king mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 50%.

Alternative 5.B: Set the MSST at (1-M)*B_{MSY} or 80% of B_{MSY}. Gulf group king mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 40%.

Alternative 5.C: Set the MSST at (1-M)*B_{MSY} or 80% of B_{MSY}. Gulf group king mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 30%.

Alternative 5.D: Set the MSST at (1-0.5)*B_{MSY} or 50% of B_{MSY}. Gulf group king mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 50%.

Alternative 5.E: Set the MSST at (1-0.5)*B_{MSY} or 50% of B_{MSY}. Gulf group king mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 40%.

Alternative 5.F: Set the MSST at (1-0.5)*B_{MSY} or 50% of B_{MSY}. Gulf group king mackerel stocks in the Gulf of Mexico will be considered

overfished if the probability that $B_{current}$ is less than MSST is greater than 30%.

Alternative 5.G: Status Quo - no action.

Discussion and Rationale: As previously stated, the National Standard Guidelines (50 CFR 600.310) require that each FMP must specify the overfished threshold (MSST) as the lower limit to the spawning stock biomass or other measure of reproductive capacity. To the extent possible, MSST should be set equal to whichever is greater - one half of the MSY stock size (B_{MSY}), or the minimum stock size at which rebuilding to B_{MSY} would be expected to occur within 10 years if the stock or stock complex were exploited at the MFMT (Restrepo et al., 1998). As with MFMT, the MSST definition must be specified in measurable terms such that the Council and the Secretary of Commerce can monitor the stock (or stock complex) to determine whether these overfishing and overfished thresholds have been crossed. Finally, technical guidance from the NMFS recommends that MSST be set at either 0.5 * B_{MSY} or (1-M) * B_{MSY} (where M is natural mortality), whichever results in the highest biomass value. This guidance is based on the fact that longer-lived, slow-growing stocks typically have lower M values, and if they become overfished, it takes longer for them to recover to B_{MSY}. Consequently, the biomass of these stocks should be maintained at a level near B_{MSY}. Whereas short-lived, faster-growing stocks have higher M values and can be rebuilt in a shorter period of time, even if biomass is reduced to levels significantly below B_{MSY}.

Gulf group king mackerel are a relatively long-lived species with M estimated at 0.2. Based on the recommendations from NMFS, MSST would thus be 80% of B_{MSY}. Proposed Alternative 5A, and Alternatives 5B and 5C use this recommendation and incorporate probabilities of 50%, 40%, and 30%, respectively, that the current spawning stock biomass as determined by the most recent stock assessment ($B_{CURRENT}$) is less than B_{MSY} for the overfished threshold. Alternatives 5D, 5E, and 5F would set MSST at the lowest biomass allowed by the M-SFCMA, 50% of $B_{MSY,}$ with the 50%, 40%, and 30% probabilities that $B_{CURRENT}$ is less than MSST, respectively. Intuitively, there is a range of possible MSST values between 50% and 100% of B_{MSY} that could be approved; however, such designations other than the alternatives presented above would have no basis in biology or in regulatory guidance, thus they would be arbitrary. Alternative 5G (status quo) would result in there not being a definition for the overfished condition of the Gulf group king mackerel stock as required by the National Standard Guidelines (50 CFR 600.310) because the NMFS previously disapproved the Council's proposed definition in the Generic SFA Amendment. This alternative is included to provide a full range of alternatives for compliance with National Environmental Policy Act (NEPA).

Alternative 5C is the most risk-adverse alternative for MSST incorporating only a 20% reduction in spawning stock biomass below B_{MSY} and the requirement of no more than a 30% chance that the estimate of $B_{CURRENT}$ is less than MSST before the overfished state is assumed. On the other hand, Alternative 5D is the most risk-prone setting MSST at 50% of B_{MSY} and using a 50-50 chance that the estimate of $B_{CURRENT}$ is less than MSST before the overfished state is determined. The other alternatives can be scaled from more risk-adverse to more risk-prone in the following

order: Alternative 5B, Proposed Alternative 5A, Alternative 5F, and Alternative 5E. This order occurs because using 80% of B_{MSY} for MSST as opposed to 50% provides far less risk regardless of the probabilities associated with the MSST estimate. The alternatives for variations in probability (30, 40, and 50%) for a given MSST level provide very little change in risk. In other words, Alternative 5C is not substantially more risk-adverse than Proposed Alternative 5A; however, both are significantly more risk-adverse than Alternatives 5D, 5E, and 5F. The reason why there is little variation in risk associated with the probabilities (30, 40, and 50%) is that when the stock assessment measures the value of $B_{CURRENT}$ relative to MSST, it utilizes a model that is run 500 times with mixed variables, and any one of the model runs is potentially the correct or most accurate one. This procedure is used to determine a range of potential $B_{CURRENT}$ values relative to MSST and the point estimate (in essence the middle of the distribution), which is the 50% probability.

In recommending the Proposed Alternative 5A, the Council accepted the technical advice of the NMFS that MSST be set at (1-M) * B_{MSY}, thus the Gulf group king mackerel stock would be declared as overfished if the spawning stock biomass is reduced to below 80% of B_{MSY}. Although using a 40% or a 30% probability with regard to this estimate as in Alternatives 5B and 5C may be slightly more precautionary, the Council believed that using the 50% probability associated with the MSST estimate was the most appropriate because it represents the best scientific estimate of MSST; it is the mid-point of the $B_{CURRENT}$ to B_{MSY} distribution in the stock assessment.

Biological Impacts: As with the alternatives for definitions of MSY, OY, and MFMT above, the setting of a definition of the overfished threshold (MSST) for Gulf group king mackerel would not result in either positive or negative biological impacts; however, management measures that would be required to rebuild the stock to B_{MSY} if it is reduced to below MSST would cause biological impacts. Figure 7 of MSAP (2002) showed that spawning stock biomass has steadily increased since about 1989-90, and the stock would not be considered as overfished based on any of the aforementioned alternatives since about 1999. In 2002 only 24% of the B_{2002} estimates were less than the Proposed Alternative 5A for MSST; however, 79% of the B_{2002} estimates were still below B_{MSY} (MSAP 2002). Consequently, although the stock is not considered as overfished based on the proposed definition, it is not fully recovered to B_{MSY}. Because of the increasing trend in spawning stock biomass since approximately 1995 under relatively stable regulations, the recovery would be expected to continue, and this recovery has resulted in biological benefits to the stock. Once the stock is fully recovered to B_{MSY}, the Proposed Alternative 5A for MSST is expected to provide a conservative threshold that would prevent the stock from becoming severely overfished in the future and requiring extensive time to recover.

It is noted that the management measures based on the level of F relative to MFMT as discussed in the previous section are most important in preventing the overfished condition from occurring. Also as previously discussed the use of $F_{30\%SPR}$ appears to be the most appropriate biological definition of MFMT that will provide optimum benefits from the Gulf group king mackerel stock and prevent overfishing. However, if due to a period of poor recruitment, increased illegal or

unrecorded harvest, or other problems that cause overfishing to occur and the biomass to be reduced below B_{MSY}, the proposed MSST level at 80% of B_{MSY} would not allow significant reductions in the spawning stock biomass before triggering a rebuilding program. Consequently, and as opposed to the previous history of management of this fishery (Table 1), it is probable that only minor adjustments to TAC and other management measures would be needed to rebuild the stock back to B_{MSY} within a short period of time.

Socioeconomic Impacts: MSST is basically a biological concept, but the current choices for MSST have significantly different socioeconomic implications when taking into account the associated management measures. The first 3 alternatives set MSST at the same level relative to B_{msy} but at different probability levels. In the same vein, the next 3 alternatives set MSST at the same level (though different from that of the first 3 alternatives) but at different probability levels. In general, the higher percentage level chosen for MSST relative to $B_{msy,}$ such as the case with the first 3 alternatives, the higher is the likelihood that current biomass would fall below the threshold, thus resulting in the adoption of more stringent measures to rebuild the stock to B_{msy}. Also, the lower the probability criterion chosen, the lower the likelihood that current biomass would fall below the threshold as to require more stringent regulations.

Given the current king mackerel spawning stock size (> 80% SS_{MSY}) and that the probability of current spawning stock size being less than 80% of B_{msy} is about 24%, the stock is not considered overfished under any of the alternatives. Lower MSST thresholds, such as Alternative 5.D would generally allow a larger harvest, which produces larger short-term socioeconomic benefits. However, such thresholds would also increase the risk of a possible future stock collapse and may eventually require a gradual reduction in the allowable harvest, with the attendant socioeconomic disruption. Setting MSST at a relatively high level, such as the case with Alternative 5.C, would produce stability in year-to-year harvest, but could also result in large negative short-term socioeconomic impacts from the relatively large forgone yields.

Although the general implications of the various alternatives for MSST have been pointed out, the choice of which alternative provides the best balance between conservation benefits and adverse socioeconomic impacts cannot be ascertained. This lack of clear choice is partly a function of the inability to determine the probability for any of the MSST alternatives that the stock is actually overfished and any associated rebuilding strategy would be successful in meeting the target MSY. For example, if all MSST alternatives have an equal probability of being "correct" such that the associated rebuilding paths would successfully rebuild the stock within 10 years, a lower MSST level which, as discussed above, associated with lower adverse socioeconomic impacts would be economically superior over others. As implied, however, in the "Biological Impacts" discussion, it appears that a higher MSST level has a higher probability of protecting the stock, whereas a lower MSST level is associated with a lower probability of protecting the stock. In this case, it would no longer hold true that a lower MSST level, which is associated with lower adverse socioeconomic impacts, would be economically better than a higher MSST level, since it is associated with lower probability that future benefits would accrue.

GULF GROUP SPANISH MACKEREL

Action 6: MSY Alternatives

Proposed Alternative 6.A: Maximum Sustainable Yield (MSY) for Gulf group Spanish mackerel is the yield associated with $F_{30\% SPR}$ when the stock is at equilibrium (currently estimated at 8.7 MP).

Alternative 6.B: MSY for Gulf group Spanish mackerel is the yield associated with $F_{25\% SPR}$ when the stock is at equilibrium (currently estimated at 8.8 MP).

Alternative 6.C: MSY for Gulf group Spanish mackerel is the yield associated with $F_{35\% SPR}$ when the stock is at equilibrium (currently estimated at 8.4 MP).

Alternative 6.D: MSY for Gulf group Spanish mackerel is the yield associated with $F_{40\% SPR}$ when the stock is at equilibrium (currently estimated at 8.0 MP).

Alternative 6.E: Status quo - no action

Discussion and Rationale: As with Gulf group king mackerel, in the Council's Generic Sustainable Fisheries Act Amendment, MSY for Gulf group Spanish mackerel was set at 30% static SPR. This value was determined by the Council to be the most appropriate based on recommendations of the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP (1997). As with Gulf group king mackerel, the NMFS rejected the Council's proposed 30% static SPR proxy definition of MSY for Gulf group Spanish mackerel because it was not expressed in biomass units as required by the National Standard Guidelines for National Standard 1 as promulgated under 50 CFR 600.310.

In readdressing the definition of MSY, the Council considered the aforementioned alternatives that are specified in terms of the yield associated with a F for a range of SPR percentages and are the same as previously discussed under Action 2 herein. The Council also considered the aforementioned recommendations of its stock assessment panels in selecting Proposed Alternative 6.A for MSY as the yield associated with $F_{30\% SPR}$. Based on this criterion, MSY for Gulf group Spanish mackerel was estimated at 8.5 MP (MSAP 1999). Although the current TAC is set at 9.1 MP, i.e., above MSY, the MSAP (2001b) noted that it is unlikely that the capacity of the current fishery could realize such a catch. Furthermore, recent years' landings have only been about 3.0 to 4.0 MP (MSAP 2002) (Table 2). The Council believed that alternatives using higher SPR levels (Alternatives 6.C and 6.D) could result in underestimating MSY, and if conditions in the fishery change such that a greater harvest is realized, it could result in more restrictive management measures being required and may not result in optimizing

yield from a fishery. Furthermore, the use of a lower SPR level (Alternative 6.B) was determined to over MSY, and again under the condition that higher catches and the associated F occur in the future, there is the potential for overfishing to occur.

Biological Impacts: As previously noted for Gulf group king mackerel, the setting of an MSY level of itself would not cause any biological impacts; however, management measures that may be required to maintain harvests at or below this level would produce biological impacts. Consequently, the biological impacts of the aforementioned alternatives would be indirect. Furthermore, the impacts could be positive or negative depending on the level of risk that is acceptable and the level at which the fishery is being prosecuted. As previously mentioned for Gulf group king mackerel, all the alternatives listed, with the possible exception of Alternative 6.B, should provide a risk-adverse MSY that would maintain a sufficient spawning stock size to prevent overfishing. Alternative 6.B is the most liberal of the MSY estimates (high MSY and F_{MSY}, and low B_{MSY} [Table 5]). If fully realized, this level of F would allow the greatest yield to be taken, but at a higher risk of long-term overfishing. Alternative 6.D is the most precautionary with the lowest associated F value and the highest associated spawning stock biomass (Table 5). The Proposed Alternative 6.A and Alternative 6.C are median MSY proxies with Alternative 6.C affording only slightly less risk. The Proposed Alternative 6.A is consistent with the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996). Fishing at or below this recommended level ($F_{30\% SPR}$) allows for the fishery to achieve the maximum long-term yield while maintaining sufficient stock size that such yields can be perpetuated with little risk of overfishing. Although MSY is currently not specifically defined, the Proposed Alternative 6.A is based on a 30% static SPR. Consequently, Alternative 6.E (no action) would provide the same F projections and yield projections within an ABC range. However, based on previous rejections of the use of SPR as a proxy for MSY by NMFS, it is questionable whether the status quo alternative is approvable. In terms of biological impacts, there would be no difference.

As previously noted, the current TAC of 9.1 MP is above the currently estimated MSY at $F_{30\% SPR}$ (Proposed Alternative 6.A) of 8.7 MP. Although a F level that would produce a catch of 9.1 MP over some extended period of time could potentially reduce spawning stock biomass to below B_{MSY}, such a scenario is not likely to happen without major changes in the fishery's capacity (MSAP 2002). Catches have remained at approximately 3.0 MP to 4.0 MP since 1994-95 (Table 2), and it is likely that due to their shorter life span of (approximately 9 years as opposed to 24 years for Gulf group king mackerel), Gulf group Spanish mackerel stocks are currently above $B_{MSY.}$ Furthermore, because the framework procedure calls for stock assessments or updates every 2 years, adjustments in TAC could be made before MSY catch levels are realized at the Proposed Alternative 6.A level of $F_{30\% SPR}$ occurs and before overfishing or the overfished condition could ensue.

Socioeconomic Impacts: The setting of MSY, F_{MSY}, and SS_{MSY} parameters does not by itself create direct socioeconomic impacts. However, it affects the determination of OY targets, MSST, and MFMT and thus the setting of harvest levels and associated management measures. Overly conservative parameters could lead to more restrictive regulation than what is necessary

to maintain the stock at sustainable levels over the long term. That, in turn, would result in unnecessary socioeconomic hardship. Conversely, selecting parameters that are not appropriately cautious could result in regulations that provide for an increased yield in the short term. But those regulations could result in a reduced yield over the long term if MSY is overestimated. One major issue, then, associated with the choice of MSY is the balancing of conservation measures with associated socioeconomic impacts. To provide some general insights into this issue, it is instructive to compare the various MSY levels with historical harvests but with some limitations noted below.

At present, the yield equivalent of MSY associated with each of the alternatives are: 8.8 MP at $F_{25\%SPR}$; 8.7 MP at $F_{30\%SPR}$; 8.4 MP at $F_{35\%SPR}$; and, 8.0 MP at $F_{40\%SPR}$. As expected, the higher the SPR level, the lower are the associated F and numerical values for MSY. The reverse occurs with respect to spawning biomass, that is, a higher biomass is associated with a higher SPR. The TAC for Gulf group Spanish mackerel was gradually increased in the late 1980's, substantially increased to 8.60 MP in the early 1990's, reduced to 7.0 MP in the late 1990's, and currently stands at 9.1 MP. Since more current TACs exceed all MSY alternatives, it appears that fishery participants may experience lower benefits from adoption of any of the MSY alternatives. However, the landings history portrays an entirely different picture. The only time total landings exceeded TAC was in the 1987/1988 and 1988/1989 fishing seasons when the respective year's TACs were 2.5 MP and 5.0 MP. The highest recorded landings since 1987/1988 stood at 7.053 MP in 1991/1992. In the last 5 years, total landings averaged at about 3.4 MP, well below the current TAC. Thus, it is that case that any of the MSY choices can accommodate the landings history.

In this regard, all MSY alternatives offer some potential for revenues and profits to the commercial sector and for-hire vessels to increase in the future. Consumer surplus to recreational anglers may also increase with the potential to harvest more and possibly larger sized fish. With the expansion at the harvest level, social and economic benefits may also ripple through the other market levels and support industries. The one important issue to note here is that the performance of the commercial sector is currently constrained by regulations, particularly the net ban imposed by Florida, so that the future benefits to this sector could hinge on the development of some innovative fishing techniques that comply with the net ban and other restrictive regulations. What these techniques are remains to be seen in the future, and their development may be partly influenced by the future consumer demand for Spanish mackerel.

If all MSY alternatives have equal probability of promoting the long-term sustainability of the stock, then the one that offers higher potential social and economic benefits may be ranked higher than that which provide lower benefits. In the absence of estimates of the social and economic benefits derived from any of the MSY alternatives, it may only be assumed that higher benefits would be with a higher MSY. In this regard, Alternative 6.B would be ranked highest and Alternative 6.D lowest. Proposed Alternative 6.A may be ranked second among the MSY alternatives. If the no action alternative were interpreted to be associated with a MSY level equivalent to that of Proposed Alternative 6.A, then this alternative may also be ranked second

overall. However, as noted above, questions have been raised regarding the appropriateness of the no action alternative for MSY specification.

In the absence of information on probabilities, one may only consider the qualitative chance of each alternative in promoting the long-term sustainability of the stock. A fishing mortality rate associated with a higher SPR level probably has a higher probability of maintaining the stock's long-term sustainability than one associated with a lower SPR. In this sense, Alternative 6.D may be considered to offer a better chance of maintaining the stock's long-term sustainability than others. However, the associated MSY level of Alternative 6.D is lower than those of others implying that the alternative's long-term socioeconomic benefits would also be lower. A better balance of stock conservation and socioeconomic benefits is preferred by either Proposed Alternative 6.A or Alternative 6.C. These two alternatives, then, may be ranked higher than the other alternatives for MSY. Again, it should be noted that future benefits to the commercial sector would be influenced by the development of innovative harvesting techniques that comply with regulations and the increase in demand for Spanish mackerel.

The foregoing discussion of the socioeconomic impacts of the various MSY alternatives was undertaken from a long-term perspective. However, some reference to short-term conditions were also made, and the basic conclusion from this perspective is that none of the MSY alternatives imply a TAC that is lower than recent or reasonably foreseeable harvests. Therefore, no economic or social impacts are expected as current harvest operations are accommodated.

Action 7: OY Alternatives

Alternative 7.A : Optimum Yield (OY) for Gulf group Spanish mackerel is the yield associated with $F_{40\% SPR}$ when the stock is at equilibrium (currently estimated at 8.0 MP).

Alternative 7.B: OY for Gulf group Spanish mackerel is the yield associated with $F_{35\%SPR}$ when the stock is at equilibrium (currently estimated at 8.4 MP).

Alternative 7.C: OY for Gulf group Spanish mackerel is the yield associated with $F_{30\%SPR}$ when the stock is at equilibrium (currently estimated at 8.7 MP).

Alternative 7.D: OY for Gulf group Spanish mackerel is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.65*F_{MSY}$ when the stock is at equilibrium (currently estimated at 8.1 MP).

Proposed Alternative 7.E: OY for Gulf group Spanish mackerel is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.75*F_{MSY}$ when the stock is at equilibrium (currently estimated at 8.3 MP).

Alternative 7.F: OY for Gulf group Spanish mackerel is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.85*F_{MSY}$ when the stock is at equilibrium (currently estimated at 8.5 MP).

Alternative 7.G OY for Gulf group Spanish mackerel is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.90*F_{MSY}$ when the stock is at equilibrium (currently estimated at 8.5 MP).

Alternative 7.H: Status quo - no action.

Discussion and Rationale: The OY alternatives listed above are the same as those discussed for Gulf group king mackerel under Action 3. The discussion of the requirements of the M-SFCMA and the guidance of the Guidelines for National Standard 1 (50 CFR Part 600.310) that are discussed in the first paragraph of the "discussion and rationale" for Action 3 are not repeated here, but are incorporated by reference.

Table 5 shows the various reductions in yield for the OY benchmark alternatives listed above. As shown for Gulf group Spanish mackerel, the Proposed Alternative 7.E (the yield associated with a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.75*F_{MSY}$ when the stock is at equilibrium) results in a yield relative to the F_{MSY} yield of 97% and is based on guidance from NMFS. Alternative 7.A that would set OY at the yield associated with fishing at $F_{40\%SPR}$ which is 93% of the $F_{30\%SPR}$ yield and Alternative 7.D that would set OY for Gulf group Spanish mackerel as the yield corresponding to $F_{OY}=0.65*F_{MSY}$ which is 94% of the $F_{30\%SPR}$ yield are the only alternatives considered that would be more conservative than Proposed Alternative 7.E. Furthermore, the Proposed Alternative 7.E allows the stock to build to 119% of the spawning stock biomass at MSY (SSB_{MSY}). Alternative 7.C is the least conservative and would result in yields equal to MSY or the $F_{30\%SPR}$ yield. Alternatives 7.G, 7.F, and 7.B also result in yields that are very near the $F_{30\%SPR}$ yield at 98%, 99%, and 99%, respectively. As previously discussed for Gulf group king mackerel under Action 3, Alternative 7.H (status quo) is probably not a viable or advisable alternative because: (1) it is not expressed in biomass terms which have previously been rejected by the NMFS, and (2) it would result in retaining the current target of a 30% static SPR which would result in yields equivalent to those at F_{MSY}. The Proposed Alternative 7.A is the most conservative of the alternatives presented, and affords the greatest protection for the stock when management is directed at this target. However, current conditions in the fishery are causing greatly reduced catches, and there currently does not appear to be a need for this level of conservatism. Finally, as discussed above, OY will be re-evaluated in accordance with the National Standard 1 Guidelines at each stock assessment (currently scheduled for even years), and any needed management adjustments can be made before the stock encounters any problems.

Biological Impacts: As previously discussed for Gulf group king mackerel in Action 4, setting an OY yield definition would not of itself cause any biological impacts; however, since OY is the management target prescribed by the M-SFCMA, management measures that would be required to keep the harvest of Gulf group Spanish mackerel at a level that would not result in overfishing

would produce biological impacts. The severity of the impacts, either positive or negative, could also vary based on the aforementioned alternatives and the level of harvest because of the relative degree of conservatism that each has. Alternative 7.C would result in the highest ABC range, and would potentially allow the highest annual catches depending on the TAC selected. As shown in MSAP (2001) the mid-point of the ABC range (which is usually selected because it is the point estimate) was 14.4 MP under this OY scenario of OY=MSY by definition. This harvest level would be approximately 5.9 MP above the currently estimated MSY of 8.5 MP because the current stock size is estimated to be well above the stock size at MSY, thus there is a surplus in spawning stock biomass. Alternative 7.A is the most conservative and would result in the lowest ABC range of between 7.2 MP and 11.3 MP and a mid-point of 9.2 MP based on the most recent biomass levels (MSAP 2001b). This level and the current TAC of 9.1 MP are also above the estimated MSY of 8.7 MP; however, these levels are still well below recent catch levels (Table 2). Alternative 7.D is only slightly less conservative than Alternative 7.A and would probably result in a similar ABC range. In summary, by definition, Alternative 7.C would incorporate the greatest level of risk while the Alternative 7.A and Alternative 7.D would provide the greatest level of protection against overfishing (Table 2). The Alternative 7.A definition may be deemed to be too conservative because the lower level of the ABC range under this OY definition (7.2 MP at current biomass levels) has not been harvested since at least the early 1980's (Table 2, MSAP 1999, 2001b). If changes occur in the fishery resulting in significantly higher harvest levels and the need for reduced catches, or if other information indicates that changes are needed to the OY benchmark, they can be accomplished through a future regulatory amendment. Alternatives 7.G and 7.F also result in equilibrium yields that are very near the $F_{30\%SPR}$ yield at 99%, while Alternative 7.B is only slightly more conservative allowing yields at 98% of the $F_{30\%SPR}$ yield. As previously noted, Proposed Alternative 7.E provides a “middle of the road” level of biological risk and is consistent with the advice provided by NMFS. It should provide a adequate level of precaution against biological impacts that might threaten the stock if conditions in the fishery change to include significantly increased harvests. Furthermore, should harvests increase dramatically, there is sufficient excess biomass that additional regulations could be implemented in time to prevent the stock from becoming overfished.

Socioeconomic Impacts: As currently worded, the specification of OY under each alternative is based mainly on biological (or perhaps ecological) considerations. Absent then is the consideration of a process that would lead to the maximization of net social and economic benefits to the nation from a given harvest yield bounded upward by MSY. From a purely economic standpoint, the process may be described as moving from MSY to a lower level such that net economic benefits from the Gulf group Spanish mackerel fishery are maximized. This lower level is termed maximum economic yield (MEY). However, achieving MEY is generally embedded in the management regime adopted. A management regime that reduces effort in the fishery, such as an IFQ program, offers a higher likelihood of achieving MEY than other management regimes. When other than purely economic factors, such as the employment, historical and cultural importance of a fishery to certain communities, are also considered in the determination of OY, the associated harvest level would be different from MEY. For example, if employment promotion is introduced into the process of determining OY, the resulting harvest

level may be higher than MEY but as prescribed by the M-SFCMA should not exceed MSY. As with MEY, a management regime would have to be developed to insure that a certain specified level of employment is achieved. Should MEY or another yield associated with achievement of other social goals (e.g. employment) equal one of the OY alternatives, such occurrence is mainly accidental.

Given the foregoing discussion, the ability to describe the socioeconomic implications of the various OY alternatives is reduced to describing the socioeconomic status of the fishery at various harvest levels associated with each choice of OY.

In general, the higher the allowable yield, the better would be the socioeconomic outcome. But this outcome has to be modified by the long-term sustainability of the stock at a chosen OY and the type of management regime adopted for the fishery. Among the alternatives, Alternative 7.A is one of the more conservative from a biological standpoint. It would result in a smaller but also more stable yield. It would also have one of the lowest likelihoods that a recovered stock biomass would drop below MSST forcing a recovery plan. All the other alternatives would allow a greater harvest, but also have a greater risk of the stock biomass dropping below MSST. Alternative 7.H (no action) offers certain perspective different from that of the other alternatives. Although, as previously discussed, the no action alternative may be considered to provide a harvest level similar to that of Alternative 7.A, it does not provide an explicit specification of OY. It is the implication of this latter aspect of the no action alternative that will be elaborated below.

The yield equivalent of OY ranges from 8.0 MP under Alternative 7.A to 8.7 MP under Alternative 7.C. Relative to actual harvest performance in the Gulf group Spanish mackerel fishery, particularly in more recent years, all OY alternatives will not result in requiring short-term harvest reductions. As with the choice for MSY, a balance between socioeconomic impacts and long-term sustainability of the king mackerel stocks needs to be achieved over the long-term.

If all OY levels have equal probability of maintaining the long-term sustainability of the stock, the preferred choice would be the alternative that can provide the highest socioeconomic benefits. This perhaps can be approximated by an alternative that provides for the highest OY level, i.e., Alternative 7.C. Considering the fact that such probability is likely to vary from alternative to alternative, with the highest (lowest) OY level likely to be associated with the least (highest) probability of maintaining the long-term sustainability of the stock, the likely best alternative would be between the extremes of Alternative 7.C and Alternative 7.A.

In terms of providing no specific OY level, the no action alternative may be interpreted in two ways. First, OY is not currently specified but would be set after the stock is fully recovered or when it is nearing full recovery. In this case, the possibility exists that socioeconomic information may be available as to be explicitly included in the specification of OY. Second, a specific OY would not be set even when the stock is fully recovered but would be simply stated as any harvest within the specified MSY. Under an open access system, OY would likely be

equal to MSY, provided total harvest is effectively controlled not to exceed MSY. But under a controlled access system, particularly of the IFQ type, OY (at least from an economic perspective) would fall below MSY.

A biological specification of OY is instructive in terms of at least knowing the yield target of managing the fishery, but specifying management solely on the basis of a biological definition of OY may not trace a path that provides the best socioeconomic results. For example, open access management measures may force the fishery to produce at the biologically specified OY, but the economic status of the fishery may be worse off than that achieved under a controlled access type of management even at lower yield levels. Unless then in this particular example, an OY is specified, implicitly or explicitly, with accompanying general management approach that would allow the fishery to be economically efficient, none of the alternatives may be considered superior over any other alternatives. If social factors are also considered, then another OY will have to be specified, with accompanying general management approach that would allow the fishery to achieve those social goals.

Although each OY alternative is specified mainly on biological grounds, socioeconomic factors can be influenced by the selection of a specific OY. As noted earlier, each OY alternative is associated with a different harvest level such that choosing one alternative over another would yield its own unique socioeconomic consequences. It is in this nature that socioeconomic factors are considered in the Council's choice of OY. One other issue to note here is that the alternative specifications of OY will accommodate current and reasonably foreseeable harvest, and therefore no economic or social impacts are expected as current operations are accommodated.

Action 8: Overfishing Threshold Alternatives (MFMT)

Proposed Alternative 8.A: Set MFMT = $F_{30\%SPR}$ = F_{MSY}. The Gulf group Spanish mackerel stock would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 50%.

Alternative 8.B: Set MFMT = $F_{30\%SPR}$ = F_{MSY}. The Gulf group Spanish mackerel stock would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 40%.

Alternative 8.C: Set MFMT = $F_{30\%SPR}$ = F_{MSY}. The Gulf group Spanish mackerel stock would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 30%.

Alternative 8.D: Set MFMT for the Gulf group Spanish mackerel stock at a fishing mortality rate equivalent to 25% static SPR ($F_{25\%SPR}$).

Alternative 8.E: Set MFMT for the Gulf group Spanish mackerel at a fishing mortality rate equivalent to 35% static SPR ($F_{35\%SPR}$).

<u>Alternative 8.F</u>: Status Quo - the MFMT for the Gulf group Spanish mackerel is a fishing mortality rate equivalent to 30% static SPR ($F_{30\%SPR}$).

<u>Discussion and Rationale</u>: The MFMT alternatives listed above are the same as those discussed for Gulf group king mackerel under Action 4. The discussion of the requirements of the M-SFCMA and the guidance of the Guidelines for National Standard 1 (50 CFR Part 600.310) that are discussed in the first paragraph of the "discussion and rationale" for Action 4 are also applicable to Gulf group Spanish mackerel and are repeated as follows with minor edits:

> The Sustainable Fisheries Act requires Councils to manage fishery resources to achieve MSY as a upper limit to OY. The National Standard Guidelines (50 CFR 600.310) also require that each FMP must specify status determination criteria for each stock or stock complex under a FMP, and such criteria must be objective and measurable to the extent possible. These status criteria are specified for determining the overfishing threshold (MFMT) as the upper limit to the fishing mortality rate (F) and the overfished threshold (MSST) as the lower limit to the spawning stock biomass or other measure of reproductive capacity. The MFMT is the level or rate of fishing mortality that, if exceeded, will result in overfishing and jeopardize the capacity of a stock to produce MSY on a continuing basis. The National Standard Guidelines (50 CFR 600.310) also require the Council to submit a plan to end overfishing if the MFMT level is being exceeded. In the Council's Generic Sustainable Fisheries Act Amendment, the Council proposed, and NMFS approved, a MFMT definition for Gulf group Spanish mackerel as: "a fishing mortality rate equivalent to 30% static SPR ($F_{30\%SPR}$)." The MSAP (1999) noted that projecting $F_{30\%}$ to attain MSY and $F_{40\%}$ to achieve OY depends upon future recruitment. Using both low and average recruitment, the MSAP (2001b) concluded that there was little chance of F exceeding $F_{30\%SPR}$ in the next few years.

Action 8 compares the appropriateness of the currently approved Alternative 8.F with other reasonable alternatives for MFMT. Alternatives 8.D, 8.E, and 8.F consider MFMT in terms of increasing risk levels from $F_{25\%SPR}$ to $F_{35\%SPR}$. These alternatives were also evaluated during the development of the Generic Sustainable Fisheries Act Amendment. At that time, Alternative 8.F (Status Quo - $F_{30\%SPR}$) was determined to be the most appropriate based on the biology of Gulf group Spanish mackerel and in the discussions and recommendations of the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP (1997). Furthermore, as discussed in the Generic Sustainable Fisheries Act Amendment, use of a higher SPR for MFMT as in Alternative 8.E could result in a more restrictive management measures than those needed to optimize yield. Also, a lower $F_{25\%SPR}$ proxy for MFMT, as in Alternative 8.D could underestimate MFMT and increase the risk of overfishing if the stock were being fully utilized. As discussed above, the stock is currently not being fully utilized and existing state and federal regulations, as well as social and economic factors are constraining F to levels well below any of the aforementioned alternatives.

The Proposed Alternative 8.A and Alternatives 8.B and 8.C utilize the previously recommended $F_{30\%SPR}$. They differ in the level of acceptable risk associated with this MFMT proxy. The level of risk comes from the bootstraping procedure of the VPA analysis in the stock assessment

that uses (in most cases) 500 simulations of $F_{CURRENT}$/MFMT to develop a percentage of simulations that may be either above or below the MFMT, designated by this slate of alternatives as $F_{30\%SPR}$ = F_{MSY}=MFMT. Because any one of the 500 bootstraps could be the correct $F_{CURRENT}/F_{30\%SPR}$ value, the 50% probability (Proposed Alternative 8.A) is in essence a point estimate that represents the best scientific evaluation of $F_{CURRENT}/F_{30\%SPR}$. Alternatives 8.B and 8.C would provide more risk-averse definitions of the overfishing threshold; however, they are arbitrary and potentially erroneous. Furthermore, the most recent stock assessment shows that there is a 0% chance that $F_{2000\text{-}01}>F_{MSY}$ utilizing $F_{30\%SPR}$ as the proxy for MFMT. In summary, Proposed Alternative 8.A is the most scientifically defensible definition; however, any of the percentage alternatives less than 50% would not change the status determination (not overfishing) under present or foreseeable conditions.

Biological Impacts: As previously discussed, the setting of a definition of the overfishing threshold (MFMT) would not result in either positive or negative biological impacts; however, management measures that would be required to keep F values at or below $F_{30\%SPR}$ or other MFMT proxies (Alternatives 8.D and 8.E) could have biological implications. MSAP (1999) showed that in the late 1980s to approximately 1993 F values for age 2+ Gulf group Spanish mackerel. Table 5 shows that F values for the stock at equilibrium for Alternatives 8.D, 8.E, or 8.F are over 2 times the presently estimated value of 0.14 (MSAP 1999). Consequently, the stock is currently being fished at a level well below even the F_{OY} recommendation of $F_{40\%SPR}$.

Although the Gulf group Spanish mackerel stock is currently not being fully utilized, it is prudent to set the overfishing threshold (MFMT) at the most scientifically defensible level in order to continue to evaluate the stock in the future and to have a trigger for implementing additional management measures in the future if needed. As previously discussed Proposed Alternative 8.A is the most appropriate based on the biology of Gulf group Spanish mackerel and in the discussions and recommendations of the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP (1997). It differs from Alternative 8.F (status quo) only in setting an acceptable level of risk associated with the bootstrapping process of the stock assessment. As previously discussed, the 50% point estimate is most appropriate. Although intuitively lower percentages may be more risk averse, they may not be any more accurate and any choice would be arbitrary.

Socioeconomic Impacts: MFMT is basically a biological concept, but it does provide the tone for setting management measures that have implications on both the stock and its exploitation by various user groups. If current fishing mortality exceeds the chosen threshold for a given probability, the stock would be considered to be undergoing overfishing, and regulatory measures have to be implemented to arrest overfishing. Proposed Alternative 8.A, Alternative 8.B and Alternative 8.C differ only in the choice of probability level. As may be expected, the lower the probability criterion, the higher is the likelihood for the stock to be declared as undergoing overfishing. As per results of the most recent stock assessment, the lower probability levels of 30% and 40% would not change the status of Gulf group Spanish mackerel as not undergoing overfishing, and no additional regulations would be needed. Considering the relatively low landings since about 1994, it is unlikely that additional more restrictive

regulations would be needed. If effort picks up in the future, the 50% probability level may be exceeded, but only then would more restrictive regulations be adopted. In a sense, the 50% probability level minimizes the adoption of restrictive regulations but perhaps provides adequate warning system for adoption of such regulations in the future.

Alternatives 8.D, 8.E, and 8.F respectively provide for lower, higher and equal fishing mortality threshold as the other alternatives, but without the probability criterion. These alternatives have similar socioeconomic implications as the other alternatives, but the resulting regulatory measures if the threshold is exceeded may be more restrictive. For example, Alternative 8.D may require more restrictive measures than Alternative 8.C even though the latter appears to be a more restrictive threshold in the event that the estimated probability of current F to exceed the threshold under Alternative 8.D is significantly lower than 30%.

Action 9: Overfished Threshold Alternatives (MSST)

Proposed Alternative 9.A: Set the minimum stock size threshold (MSST) at (1-M)*B_{MSY} or 70% of B_{MSY}. Gulf group Spanish mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 50%.

Alternative 9.B: Set the MSST at (1-M)*B_{MSY} or 70% of B_{MSY}. Gulf group Spanish mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 40%.

Alternative 9.C: Set the MSST at (1-M)*B_{MSY} or 70% of B_{MSY}. Gulf group Spanish mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 30%.

Alternative 9.D: Set the MSST at (1-0.5)*B_{MSY} or 50% of B_{MSY}. Gulf group Spanish mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 50%.

Alternative 9.E: Set the MSST at (1-0.5)*B_{MSY} or 50% of B_{MSY}. Spanish mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 40%.

Alternative 9.F: Set the MSST at (1-0.5)*B_{MSY} of 50% of B_{MSY}. Spanish mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 30%.

Alternative 9.G: Status Quo - no action.

Discussion and Rationale: The MSST alternatives listed above are the same as those discussed for Gulf group king mackerel under Action 5 with the exception that 1-M*B_{MSY} = 70% of B_{MSY}

for Gulf group Spanish mackerel because for this stock the estimated M=0.3. The discussion of the requirements of the M-SFCMA and the guidance of the Guidelines for National Standard 1 (50 CFR Part 600.310) that are discussed in the first paragraph of the "discussion and rationale" for Action 5 are also applicable to Gulf group Spanish mackerel. These discussions are not repeated here, but are incorporated by reference.

Gulf group Spanish mackerel are a relatively short-lived species (maximum age at approximately 9 years [Fable et al. 1987]) with M estimated at 0.3. Consequently, based on the recommendations from NMFS, MSST would be 70% of B_{MSY}. Proposed Alternative 9A, and Alternatives 9B and 9C use this MSST proxy and incorporate probabilities of 50%, 40%, and 30%, respectively, that the current spawning stock biomass, as determined by the most recent stock assessment ($B_{CURRENT}$), is less than B_{MSY} for the overfished threshold. Alternatives 9D, 9E, and 9F would set MSST at 50% of B_{MSY} which is the lowest biomass allowed by the M-SFCMA, with the 50%, 40%, and 30% probabilities that $B_{CURRENT}$ is less than MSST, respectively. As discussed under Action 5, there is a potential range of possible MSST values between 50% and 100% of B_{MSY} that could potentially be approved under the strict interpretation of the M-SFCMA. However, such designations other than the alternatives presented above would have no basis in biology or in legal guidance from the M-SFCMA or regulations, thus they would be arbitrary. Because of the disapproval of the Council's previously submitted definition of MSST by NMFS, Alternative 9G (status quo) would result in there not being a definition for the overfished condition of the Gulf group Spanish mackerel stock as required by the National Standard Guidelines (50 CFR 600.310). This alternative is included solely for the purpose of compliance with NEPA.

Alternative 9C is the most risk-adverse alternative for MSST incorporating only a 30% reduction in spawning stock biomass below B_{MSY} and the requirement of no more than a 30% chance that the estimate of $B_{CURRENT}$ is less than this MSST before the overfished state is assumed. On the other hand, Alternative 9D is the most risk-prone setting MSST at 50% of B_{MSY} and using a 50-50 chance that the estimate of $B_{CURRENT}$ is less than MSST before the overfished state is determined. The other alternatives can be scaled from more risk-adverse to more risk-prone in the following order: Alternative 9.B, Proposed Alternative 9.A, Alternative 9.F, and Alternative 9.E. This order occurs because using 70% of B_{MSY} for MSST as opposed to 50% provides far less risk regardless of the probabilities associated with the MSST estimate itself. The alternatives for variations in probability (30%, 40%, and 50%) for a given MSST level provide very little change in risk. In other words, Alternative 9.C is not substantially more risk-adverse than Proposed Alternative 9.A; however, both are significantly more risk-adverse than Alternatives 9.D, 9.E, and 9.F.

The reason why there is little variation in risk associated with the probabilities (30%, 40%, and 50%) is that when the stock assessment measures the value of $B_{CURRENT}$ relative to MSST (1-M, where M=0.3), it utilizes a model that is usually run 500 times with mixed variables, and any one of the model runs is potentially the correct or most accurate one. This procedure is used to determine a range of potential $B_{CURRENT}$ values relative to that particular MSST (based on M=0.3) and the point estimate (in essence the middle of the distribution), which is the 50% probability. The reason why there is a substantial difference in risk between MSST =50% of

B_{MSY} (Alternatives 9.D, 9.E, and 9.F) and MSST =70% of B_{MSY} (Proposed Alternative 9.A and Alternatives 9.B and 9.C) is that it is tantamount to changing M in the stock assessment from 0.3 to 0.5. For example, as stated by Williams (2001) for cobia, $B_{CURRENT}/B_{MSY}$ is highly dependent on the choice of M in the assessment. In evaluating 3 different values (M=0.2, M=0.3, and M=0.4), he noted that at M=0.2 the stock would be considered depleted; at M=0.3 it would be near B_{MSY}; and at M=0.4 it would be well above B_{MSY}. Consequently, Proposed Alternative 9.A and Alternatives 9.B and 9.C only vary risk around a given M value equal to 0.3; whereas 9D, 9E, and 9F totally change the MSST to a higher value that presumes a larger MSY that is much more risk- prone.

In recommending the Proposed Alternative 9A, the Council accepted the technical advice of the NMFS and its scientific advisory panels that MSST be set at (1-M) * B_{MSY}, thus the Gulf group Spanish mackerel stock would be declared as overfished if the spawning stock biomass is reduced to below 70% of B_{MSY}. Although using a 40% or a 30% probability with regard to this estimate as in Alternatives 9B and 9C may be slightly more precautionary, the Council determined that the 50% probability associated with the MSST estimate was the best scientific estimate of MSST because it is the mid-point of the $B_{CURRENT}$ to B_{MSY} distribution in the stock assessment.

Biological Impacts: As with the alternatives for definitions of MSY, OY, and MFMT above, the setting of a definition for the overfished threshold (MSST) for Gulf group Spanish mackerel would not result in either positive or negative biological impacts; however, management measures that would be required to rebuild the stock to B_{MSY} if it was reduced to below MSST would cause biological impacts. Currently, MSAP (2001b) estimated the spawning stock biomass for Gulf group Spanish mackerel at approximately 1.5 times B_{MSY}. Consequently, the stock would not be considered as overfished under any of the alternatives for MSST. Furthermore, using a MSST definition of 1-M * B_{MSY} there was a 0% chance that the stock would be considered as overfished.

As previously noted management measures based on the level of F relative to MFMT are most important in preventing the overfished condition from occurring. Also as previously discussed the use of $F_{30\%SPR}$ appears to be the most appropriate biological definition of MFMT that will provide optimum benefits from the Gulf group Spanish mackerel stock and prevent overfishing. Also, as previously stated the current TAC level is above the estimated MSY level; consequently, if the harvest were to equal or exceed TAC for even a few years, the stock could experience overfishing and, if continued, become overfished. Such conditions are not likely to occur based on current gear restrictions and other social and economic conditions in the fishery. Additionally, if harvests begin to rise there is ample cushion in the spawning stock biomass relative to B_{MSY} such that management measures, e.g. lowering TAC, could be implemented before the stock actually entered a overfished condition.

Socioeconomic Impacts: MSST is basically a biological concept, but the current choices for MSST have significantly different socioeconomic implications when taking into account the associated management measures. The first 3 alternatives set MSST at the same level relative to

B_{MSY} but at different probability levels. In the same vein, the next 3 alternatives set MSST at the same level (though different from that of the first 3 alternatives) but at different probability levels. In general, the higher percentage level chosen for MSST relative to $B_{MSY,}$ such as the case with the first 3 alternatives, the higher is the likelihood that current biomass would fall below the threshold, thus resulting in the adoption of more stringent measures to rebuild the stock to B_{MSY}. Also, the lower the probability criterion chosen, the lower the likelihood that current biomass would fall below the threshold.

Given that the current Gulf group Spanish mackerel spawning stock size is approximately 150% of SS_{MSY}, the stock is not considered overfished under any of the alternatives for MSST at 70% or 50% of B_{MSY}. Lower MSST thresholds, such as Alternative 9.D would generally allow a larger harvest, which produces larger short-term socioeconomic benefits. However, such thresholds would also increase the risk of a possible future stock collapse and may eventually require a gradual reduction in the allowable harvest, with the attendant socioeconomic disruption. Setting MSST at a relatively high level, such as the case with Alternative 9.C, would produce stability in year-to-year harvest, but could also result in large negative short-term socioeconomic impacts from the relatively large forgone yields, although given the landings history such occurrence may be deemed very unlikely in the near future.

Although the general implications of the various alternatives for MSST have been pointed out, the choice of which alternative provides the best balance between conservation benefits and adverse socioeconomic impacts cannot be ascertained. This lack of clear choice is partly a function of the inability to determine the probability for any of the MSST alternative that the stock is actually overfished and any associated rebuilding strategy would be successful in meeting the target MSY. For example, if all MSST alternatives have an equal probability of being "correct" such that the associated rebuilding paths would successfully rebuild the stock within 10 years, a lower MSST level which, as discussed above, is associated with lower adverse socioeconomic impacts would be economically superior over others. As implied, however, in the "Biological Impacts" discussion, it appears that a higher MSST level has a higher probability of protecting the stock, whereas a lower MSST level is associated with a lower probability of protecting the stock. In this case, it would no longer hold true that a lower MSST level, which is associated with lower adverse socioeconomic impacts, would be economically better than a higher MSST level, since it is associated with lower probability that future benefits would accrue.

COBIA

Action 10: MSY Alternatives

Proposed Alternative 10.A: Maximum Sustainable Yield (MSY) for the cobia stock in the Gulf of Mexico is the yield associated with F_{MSY} when the stock is at equilibrium (currently estimated at 1.489 MP).

Alternative 10.B: MSY for the cobia stock in the Gulf of Mexico is the yield associated with $F_{25\% SPR}$ when the stock is at equilibrium (currently estimated at 1.381 MP).

Alternative 10.C: MSY for the cobia stock in the Gulf of Mexico is the yield associated with $F_{30\% SPR}$ when the stock is at equilibrium (currently estimated at 1.467 MP).

Alternative 10.D: MSY for the cobia stock in the Gulf of Mexico is the yield associated with $F_{35\% SPR}$ when the stock is at equilibrium (currently estimated at 1.489 MP).

Alternative 10.E: MSY for the cobia stock in the Gulf of Mexico is the yield associated with $F_{40\% SPR}$ when the stock is at equilibrium (currently estimated at 1.470 MP).

Alternative 10.F: Status quo - no action

Discussion and Rationale: As previously mentioned for Gulf group king and Spanish mackerel, MSY for cobia was set at 30% static SPR in the Council's Generic Sustainable Fisheries Act Amendment. Again, this value was determined by the Council to be the most appropriate based on recommendations of the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP (1997). The NMFS rejected the Council's proposed 30% static SPR proxy definition of MSY for Gulf group king and Spanish mackerel, as well as cobia because they were not expressed in biomass units as required by the National Standard Guidelines for National Standard 1 as promulgated under 50 CFR 600.310.

The Council is readdressing the definition of MSY in the aforementioned alternatives that are specified in terms of the yield associated with F_{MSY} (currently estimated at 1.489 MP), as well as F for a range of SPR percentages. The Council also considered the recommendations of its stock assessment panel (MSAP 2001a) in selecting Proposed Alternative 10.A for MSY as the yield associated with F_{MSY}. Based on this criterion, MSY for cobia in the Gulf was estimated at 1.489 MP (Table 6). As shown in Table 6, the choice of Alternatives 10.B and 10.C would result in lower equilibrium yields at higher F values than Proposed Alternative 10.A or Alternatives 10.D and 10.E. Consequently, these alternatives are probably inappropriate proxies for MSY because they would likely result in catches exceeding MSY and ultimately lead to overfishing or the stock becoming overfished. Alternative 10.D that uses the yield at $F_{35\%SPR}$ as the MSY proxy is virtually identical to the Proposed Alternative 10.A (that uses F_{MSY}); however, the spawning stock biomass is slightly larger. Because of the paucity of data used to generate these values and the large amount of uncertainty involved in the assessment, there is probably

very little difference, if any, between these 2 alternatives. Although no TAC is currently specified for cobia, Table 3 shows that recent years catches have been below estimated catch under the proposed Proposed Alternative 10.A.

Biological Impacts: As previously stated, the setting of an MSY level would not cause any biological impacts; however, management measures that may be needed to maintain harvests at or below this level would produce biological impacts. Consequently, the biological impacts of the aforementioned alternatives would be indirect. Furthermore, the impacts could be positive or negative depending on the level of risk that is acceptable and the level at which the fishery is being prosecuted. Table 6 shows that Alternatives 10.B and 10.C would result in lower equilibrium yields at higher F values than Proposed Alternative 10.A which is the estimate of the F value that will produce MSY. Although there is a large amount of uncertainty around these estimates (see footnote for Table 6), the choice of either of these 2 alternatives as a proxy for MSY could result in catches exceeding MSY and ultimately lead to overfishing or the stock becoming overfished. As previously mentioned, Alternative 10.D would be almost identical to Proposed Alternative 10.A; however, Table 6 shows that Proposed Alternative 10.A provides the actual estimate of yield at F_{MSY}. Furthermore, the Proposed Alternative 10.A is consistent with the recommendations of MSAP (2001a) with concurrence from the Scientific and Statistical Committee (SSC).

Alternative 10.C is similar to the MSY definition previously recommended by the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) in that it is based on a 30% static SPR. However, these recommendations were made before Williams (2001) completed the current stock assessment for cobia. As previously stated this alternative would be more risk prone and could cause the stock to decline if these catches were achieved under existing management measures. Alternative 10.F (no action) would result in there not being a definition of MSY as required for all managed stocks.

Socioeconomic Impacts: The setting of MSY, F_{MSY}, and SS_{MSY} parameters does not by itself create socioeconomic impacts. However, it affects the determination of OY targets, MSST, and MFMT and thus the setting of harvest levels and associated management measures. Overly conservative parameters could lead to more restrictive regulation than what is necessary to maintain the stock at sustainable levels over the long term. That, in turn, would result in unnecessary socioeconomic hardship. Conversely, selecting parameters that are not appropriately cautious could result in regulations that provide for an increased yield in the short term. But those regulations could result in a reduced yield over the long term if MSY is overestimated. One major issue, then, associated with the choice of MSY is the balancing of conservation measures with associated socioeconomic impacts. To provide some general insights into this issue, it is instructive to compare the various MSY levels with historical harvests but with some limitations noted below.

The presently estimated yield equivalent of MSY associated with each of the alternatives are: 1.489 MP at F_{MSY}; 1.381 MP at $F_{25\%SPR}$; 1.467 MP at $F_{30\%SPR}$; 1.489 MP at $F_{35\%SPR}$; and, 1.470 MP at $F_{40\%SPR}$. As expected, the higher the SPR level above F_{MSY}, the lower are the associated

F and numerical values for MSY. The reverse occurs with respect to spawning biomass, that is, a higher biomass is associated with a higher SPR.

At present, there is no TAC specified for cobia. This fishery is regulated mainly through a size limit of 33 inches FL and a bag limit of 2 fish per person for both the commercial and recreational sectors. Total commercial and recreational landings ranged from a low of 99,000 pounds in 1980 to a peak of 2.44 MP in 1997. Total landings averaged annually at 1.43 MP for the period 1990-2000. If the peak year of 1997 were excluded, landings would average annually at 1.33 MP. Average landings for the last three years stood at 1.23 MP. For the period 1990-2000, the recreational sector accounted for about 85% of total landings. The record total harvest in 1997 was solely due to the large increase in recreational catch. In fact, commercial harvests fell in 1997 relative to earlier years. Incidentally, logbook information reveals that there are 469 vessels with commercial reef fish permits that recorded cobia landings. Noting the restrictive regulations affecting both the commercial and recreational sectors, commercial landings of cobia are most likely incidental catches by commercial vessels. Anecdotal information claims that some red snapper vessels catch cobia on their way back from fishing red snapper and other reef fish species.

More recent landings of 1.23 MP can be accommodated by any of the MSY alternatives. The preferred MSY, which provides an equivalent yield of 1.49 MP, provides some future prospects for an increase in benefits to the fishery in the future. In addition, the selection of such MSY requires no change in present regulations to control harvest to levels that would jeopardize the long-term sustainability of the fishery. However, despite the relatively restrictive regulations imposed on the cobia fishery, it appears that there is enough capacity in the fishery that can drive total landings to exceed some or all of the MSY alternatives. This condition presents some potential for revenues and profits to the commercial sector and for-hire vessels to decrease in the future. Consumer surplus to recreational anglers may also decrease with the potential to harvest fewer fish. Considering that the recreational sector accounts for most of cobia landings, this sector may be the one more adversely affected by adoption of any of the MSY alternative, at least in the near term. However, if these MSY values reflect long-term sustainability of the stock, the viability of the cobia commercial and recreational fishery would be preserved through the adoption an MSY value, albeit at relatively low level of benefits.

If all MSY alternatives have equal probability of promoting the long-term sustainability of the stock, then the one that offers higher potential social and economic benefits may be ranked higher than that which provide lower benefits. In the absence of estimates of the social and economic benefits derived from any of the MSY alternatives, it may only be assumed that higher benefits would be associated with a higher MSY. In this regard, Proposed Alternative 10.A and Alternative 10.D would be ranked highest and Alternative 10.B lowest. If the no action alternative were interpreted to be associated with MSY level equivalent to that of Alternative 10.C, then this alternative may also be ranked second lowest overall. However, as noted above, questions have been raised regarding the appropriateness of the no action alternative for MSY specification.

In the absence of information on probabilities, one may only consider the qualitative chance of each alternative in promoting the long-term sustainability of the stock. A fishing mortality rate associated with a higher SPR level probably has a higher probability of maintaining the stock's long-term sustainability than one associated with a lower SPR. In this sense, Alternative 10.E may be considered to offer a better chance of maintaining the stock's long-term sustainability than others. However, the associated MSY level of Alternative 10.E is lower than those of others (except Alternative 10.B) implying that the alternative's long-term socioeconomic benefits would also be lower. A better balance of stock conservation and socioeconomic benefits is offered by either Proposed Alternative 10.A or Alternative 10.D. These two alternatives, then, may be ranked higher than the other alternatives for MSY.

The foregoing discussion of the socioeconomic impacts of the various MSY alternatives was undertaken from a long-term perspective. However, some reference to short-term conditions were also made, and the basic conclusion from this perspective is that most of the MSY alternatives imply a total allowable catch that is higher than recent or reasonably foreseeable harvests. Therefore, there is some potential for economic or social impacts to remain unaffected as near-term harvest operations can be accommodated by the MSY alternatives, including the preferred MSY alternative.

Action 11: OY Alternatives

Alternative 11.A: Optimum Yield (OY) for the cobia stock in the Gulf of Mexico is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.65*F_{MSY}$ when the stock is at equilibrium (currently estimated at 1.405 MP).

Proposed Alternative 11.B: OY for the cobia stock in the Gulf of Mexico is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.75*F_{MSY}$ when the stock is at equilibrium (currently estimated at 1.452 MP).

Alternative 11.C: OY for the cobia stock in the Gulf of Mexico is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.85*F_{MSY}$ when the stock is at equilibrium (currently estimated at 1.476 MP).

Alternative 11.D: OY for the cobia stock in the Gulf of Mexico is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.90*F_{MSY}$ when the stock is at equilibrium (currently estimated at 1.484 MP).

Alternative 11.E: OY for the cobia stock in the Gulf of Mexico is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=F_{25\%SPR}$ when the stock is at equilibrium (currently estimated at 1.381 MP).

Alternative 11.F: OY for the cobia stock in the Gulf of Mexico is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=F_{30\%SPR}$ when the stock is at equilibrium (currently estimated at 1.467 MP).

Alternative 11.G: OY for the cobia stock in the Gulf of Mexico is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=F_{35\%SPR}$ when the stock is at equilibrium (currently estimated at 1.489 MP).

Alternative 11.H: OY for the cobia stock in the Gulf of Mexico is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=F_{40\%SPR}$ when the stock is at equilibrium (currently estimated at 1.470 MP).

Alternative 11.I: Status quo - no action.

Discussion and Rationale: The OY alternatives listed above are the same as those discussed for Gulf group king mackerel under Action 3 and Gulf group Spanish mackerel with the exception that an additional Alternative 11.E was added to evaluate the yield corresponding $F_{25\%SPR}$ when the stock is at equilibrium. The discussion of the requirements of the M-SFCMA and the guidance of the Guidelines for National Standard 1 (50 CFR Part 600.310) that are discussed in the first paragraph of the "discussion and rationale" for Action 3 are not repeated here, but are incorporated by reference.

Table 6 shows the various reductions in yield for cobia as well as F values and spawning stock biomass estimates for the OY benchmark alternatives listed above. Alternative 11.H (yield associated with fishing at the $F_{40\%SPR}$) results in a yield relative to the F_{MSY} yield of 99%, whereas Proposed Alternative 11.B (the yield associated with 0.75 * F_{MSY} and based on guidance from NMFS) results in a yield of 97% of the F_{MSY} yield, thus it is slightly more risk-adverse than Alternative 11.H. Proposed Alternative 11.B was also recommended by the MSAP (2001a) and supported by the SSC. Alternatives 11.F and 11.C provide approximately the same yield and yield/MSY as Alternative 11.H at 98% and 99%, respectively; however, Alternative 11.F results in a much higher F value and lower spawning stock biomass (Table 6). Alternatives 11.D and 11.G provide about the same yield as fishing at F_{MSY}; however, Alternative 11.G provides for a higher spawning stock biomass of the two. Alternative 11.A would set OY for cobia as the yield corresponding to $F_{OY}=0.65*F_{MSY}$ which is 94% of the yield at F_{MSY}. This OY proxy may be deemed to be too conservative and would likely result in fishing mortality rates above this F_{OY} under current management measures (See Figure 7, MSAP 2001a). Alternative 11.E would set the OY proxy at the yield corresponding to a fishing mortality rate of $F_{25\%SPR}$ which would allow for the highest F values and the lowest spawning stock biomass; consequently, it would be the most risk-prone of all the alternatives being considered.

The Proposed Alternative 11.B would allow the cobia stock to be maintained at 130% of the spawning stock biomass at MSY (SSB_{MSY}). Only Alternative 11.A (the most conservative) allows for a slightly higher SSB/SSB_{MSY} ratio at 145%. Although Proposed Alternative 11.B is more conservative, it would result in a reduction in yield of only approximately 18,000 pounds

as opposed to Alternative 11.H, and only a 46,000 pound increase over Alternative 11.A. Alternative 11.I (status quo) is probably not a viable alternative because, like Gulf group king and Spanish mackerel, the previous proposed definition of OY for cobia was expressed as 40% static SPR and was previously rejected by the NMFS. Consequently, the currently approved target definition of OY for cobia is 30% static SPR. This status quo action (Alternative 11.I) would result in essentially the same equilibrium yield as Alternative 11.F and would be only slightly less risk-prone than Alternative 11.E. Because these alternatives are the most risky, and Alternative 11.I is not stated in biomass terms, it is not likely that any would be approvable. The Proposed Alternative 11.B is the second most conservative of the alternatives presented; however, it would appear to afford sufficient protection for the stock while allowing a slightly higher yield than Alternatives 11.C and 11.H. Finally, as discussed above, OY will be re-evaluated in accordance with the National Standard 1 Guidelines during future stock assessments, and any needed changes to existing management measures can be made at that time.

Biological Impacts: As previously discussed for Gulf group king and Spanish mackerel, setting an OY yield definition would not of itself cause any biological impacts; however, since OY is the management target prescribed by the M-SFCMA, management measures that would be required to keep the harvest of cobia at that level and not result in overfishing could produce biological impacts. The severity of the impacts, either positive or negative, could also vary based on the degree of conservatism afforded by each of the aforementioned alternatives because all of the OY alternatives are expressed in terms of a yield associated with a given F value. A higher F value could result in a larger the allowable harvest, but at a greater biological risk of overfishing. As discussed above Alternative 11.E would result in the highest F value and probably the highest ABC range and catches depending on the management measures enacted. However, it is likely that if these F values were achieved, the long-term yield would be less as the SSB would probably be reduced to below SSB_{MSY} (Table 6). Alternative 11.F would probably have similar results as Alternative 11.E, albeit less severe if catches could be achieved. Alternative 11.A would be the most conservative proxy for OY; however, it would probably force additional restrictions on the cobia fishery that do not appear to be needed based on advice from MSAP (2001a) and the SSC. Alternatives 11.C, 11.D, and 11.G could result in fishing at or only slightly below F_{MSY}. Thus, if these catches could be realized, there would be a greater risk that overfishing could occur than with Proposed Alternative 11.B or Alternative 11.H. As previously discussed, either Proposed Alternative 11.B or Alternative 11.H would provide an appropriate catch level at OY that would afford sufficient biological protection from overfishing and not result in the need for additional management measures with Proposed Alternative 11.B being slightly more risk-adverse. Catches above these levels have only occurred 4 times since 1980 (see Table 3 and Table 6). Alternative 11.I would not have any biological impacts because it would not establish an approvable OY definition.

Socioeconomic Impacts: As currently worded, the specification of OY under each alternative is based mainly on biological (or perhaps ecological) considerations. Absent then is the consideration of a process that would lead to the maximization of net social and economic benefits to the nation from a given harvest yield bounded upward by MSY. From a purely

economic standpoint, the process may be described as moving from MSY to a lower level such that net economic benefits from the cobia fishery are maximized. This lower level is termed maximum economic yield (MEY). However, achieving MEY is generally embedded in the management regime adopted. A management regime that reduces effort in the fishery, such as an IFQ program, offers a higher likelihood of achieving MEY than other management regimes. When other than purely economic factors, such as the employment, historical and cultural importance of a fishery to certain communities, are also considered in the determination of OY, the associated harvest level would be different from MEY. For example, if employment promotion is introduced into the process of determining OY, the resulting harvest level may be higher than MEY but as prescribed by the M-SFCMA should not exceed MSY. As with MEY, a management regime would have to be developed to insure that a certain specified level of employment is achieved. Should MEY or another yield associated with achievement of other social goals (e.g. employment) equal one of the OY alternatives, such occurrence is mainly accidental.

Given the foregoing discussion, the ability to describe the socioeconomic implications of the various OY alternatives is reduced to describing the socioeconomic status of the fishery at various harvest levels associated with each choice of OY.

In general, the higher the allowable yield, the better would be the socioeconomic outcome. But this outcome has to be modified by the long-term sustainability of the stock at a chosen OY and the type of management regime adopted for the fishery. Among the alternatives, Alternative 11.A is the most conservative from a biological standpoint. It would result in a smaller but the most stable yield. Alternative 11.H and Proposed Alternative 11.B would also have low likelihoods that a recovered stock biomass would drop below MSST that triggers the development of a recovery plan. It is interesting to note that Alternative 11.E would allow lower harvest levels than the mentioned three alternatives, but this is likely because it would result in the lowest SSB and have a higher risk of the cobia stock falling below MSST. Alternative 11.I (no action) offers certain perspective different from that of other alternatives in the sense that it implies no specified OY. Some discussion on the no action alternative is made below.

The yield equivalent of OY ranges from 1.38 MP under Alternative 11.E. to 1.49 MP under Alternative 11.G, with OY being estimated at 1.45 MP under Proposed Alternative 11.B. As with MSY, most if not all OY alternatives may not result in requiring short-term harvest reductions when compared with more recent harvest performance in the cobia fishery. But the harvest performance of 1997 shows that there is enough capacity in the fishery to result in total landings that would exceed any of the OY alternatives. However, as with the choice for MSY, a balance between socioeconomic impacts and long-term sustainability of the cobia stocks needs to be achieved.

If all OY levels have equal probability of maintaining the long-term sustainability of the stock, the preferred choice would the alternative that can provide the highest socioeconomic benefits. This perhaps can be approximated by an alternative that provides for the highest OY level, i.e.,

Alternative 11.G. Considering the fact that such probability is likely to vary from alternative to alternative, with the highest (lowest) OY level likely to be associated with the least (highest) probability of maintaining the long-term sustainability of the stock, the likely best alternative would be between the extremes of Alternative 11.E and Alternative 11.G.

In terms of providing no specific OY level, the no action alternative may be interpreted in two ways. First, OY is not currently specified but would be set after the stock is fully recovered or when it is nearing full recovery. In this case, the possibility exists that socioeconomic information may be available as to be explicitly included in the specification of OY. Second, a specific OY would not be set even when the stock is fully recovered but would be simply stated as any harvest within the specified MSY. Under an open access system, OY would likely be equal to MSY, provided total harvest is effectively controlled not to exceed MSY. But under a controlled access system, particularly of the IFQ type, OY (at least from an economic perspective) would fall below MSY.

A biological specification of OY is instructive in terms of at least knowing the yield target of managing the fishery, but specifying management solely on the basis of a biological definition of OY may not trace a path that provides the best socioeconomic results. For example, open access management measures may force the fishery to produce at the biologically specified OY, but the economic status of the fishery may be worse off than that achieved under a controlled access type of management even at lower yield levels. Unless then in this particular example, an OY is specified, implicitly or explicitly, with accompanying general management approach that would allow the fishery to be economically efficient, none of the alternatives may be considered superior over any other alternatives. If social factors are also considered, then another OY will have to be specified, with an accompanying general management approach that would allow the fishery to achieve those social goals.

Although each OY alternative is specified mainly on biological grounds, socioeconomic factors can be influenced by the selection of a specific OY. As noted earlier, each OY alternative is associated with a different harvest level such that choosing one alternative over another would yield its own unique socioeconomic consequences. It is in this nature that socioeconomic factors are considered in the Council's choice of OY. One other issue to note here is that the alternative specifications of OY can accommodate current and reasonably foreseeable harvest, and therefore no adverse economic or social impacts may ensue from adoption of OY, at least in the short term.

Action 12: Overfishing Threshold Alternatives (MFMT)

> **<u>Proposed Alternative 12.A</u>: Set MFMT = F_{MSY}. The cobia stock in the Gulf of Mexico would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 50%.**

Alternative 12.B: Set MFMT = F_{MSY}. The cobia stock in the Gulf of Mexico would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 40%.

Alternative 12.C: Set MFMT = F_{MSY}. The cobia stock in the Gulf of Mexico would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 30%.

Alternative 12.D: Set MFMT for the cobia stock in the Gulf of Mexico at a fishing mortality rate equivalent to 25% static SPR ($F_{25\%SPR}$).

Alternative 12.E: Set MFMT for the cobia stock in the Gulf of Mexico at a fishing mortality rate equivalent to 35% static SPR ($F_{35\%SPR}$).

Alternative 12.F: Status Quo - the MFMT for the cobia stock in the Gulf of Mexico is a fishing mortality rate equivalent to 30% static SPR ($F_{30\%SPR}$).

Discussion and Rationale: The MFMT alternatives listed above are the same as those discussed for Gulf group king and Spanish mackerel under Action 4 and 8, respectively with minor changes. The discussion of the requirements of the M-SFCMA and the guidance of the Guidelines for National Standard 1 (50 CFR Part 600.310) have previously been discussed in the first paragraph of the "discussion and rationale" for Action 4 for Gulf group king mackerel and they are also applicable to Gulf group Spanish mackerel and cobia. This paragraph is repeated as follows with minor edits:

> The Sustainable Fisheries Act requires Councils to manage fishery resources to achieve MSY as a upper limit to OY. The National Standard Guidelines (50 CFR 600.310) also require that each FMP must specify status determination criteria for each stock or stock complex under a FMP, and such criteria must be objective and measurable to the extent possible. These status criteria are specified for determining the overfishing threshold (MFMT) as the upper limit to the fishing mortality rate (F) and the overfished threshold (MSST) as the lower limit to the spawning stock biomass or other measure of reproductive capacity. The MFMT is the level or rate of fishing mortality that, if exceeded, will result in overfishing and jeopardize the capacity of a stock to produce MSY on a continuing basis. The National Standard Guidelines (50 CFR 600.310) also require the Council to submit a plan to end overfishing if the MFMT level is being exceeded. In the Council's Generic Sustainable Fisheries Act Amendment, the Council proposed, and NMFS approved, a MFMT definition for cobia as: "a fishing mortality rate equivalent to 30% static SPR ($F_{30\%SPR}$)."

Action 12 compares the appropriateness of the currently approved Alternative 12.F with other alternatives for MFMT. When the Council's Generic Sustainable Fisheries Act Amendment was developed and partially approved by NMFS, no stock assessment information was available to actually compare actual estimates of F_{MSY} with other $F_{PERCENTSPR}$ values as with Alternatives

12.D, 12.E, and 12.F. Furthermore, when Alternative 12.F was adopted and approved, it was based on the point estimate (50%). Williams (2001) estimated MSY and F_{MSY} directly in his analysis of the cobia stock in the Gulf. Further analyses by Williams (unpublished data) (Table 6) compared F_{MSY} to various other benchmarks including $F_{25\%SPR}$, $F_{35\%SPR}$, and $F_{40\%SPR}$. As shown, F_{MSY} is most closely represented by $F_{35\%SPR}$. Consequently, regardless of the probabilities of $F_{CURRENT}/F_{MSY}$, as shown in Proposed Alternative 12.A and Alternatives 12.B, and 12.C, utilizing MFMT = $F_{30\%SPR}$ = F_{MSY} as with Gulf group king and Spanish mackerel would result in a proxy definition of MFMT at an F value greater than F_{MSY} and ultimately lead to a SSB being less than SSB_{MSY}. Thus, MSAP (2001a) used a direct relationship of $F_{CURRENT}/F_{MSY}$ to determine if overfishing was occurring in its recommendation. Alternative 12.D would result in even greater risk of overfishing with a higher F and an expected lower SSB than Alternative 12.F (Table 6). Of the alternatives presented for MFMT expressed as a percent SPR, Alternative 12.E ($F_{35\%SPR}$) would appear to be the best choice for a MFMT proxy for cobia in the Gulf; however, the Council may want to specify a probability level upon which to measure $F_{CURRENT}/F_{MSY}$ (or $F_{35\%SPR}$) in future stock assessments.

The Proposed Alternative 12.A and Alternatives 12.B and 12.C utilize the previously recommended MFMT=F_{MSY} (MSAP 2001a). They differ in the level of acceptable risk associated with this estimate. The stock assessment for cobia used a forward projecting, age-structured population model to fit approximately 136 different variables, adding these parameters to the model in phases (Williams 2001). Although the model used to assess the status of cobia is different from that used for Gulf group king and Spanish mackerel, the numerous runs of the model with varying inputs were included to determine the most likely percentage of $F_{CURRENT}/F_{MSY}$. This value is in essence the point estimate depicted by Proposed Alternative 12.A that represents the best scientific evaluation of $F_{CURRENT}/F_{MSY}$. There is an extreme amount of uncertainty in the stock assessment for cobia as opposed to Gulf group king and Spanish mackerel due to the lack of data. Although Alternatives 12.B and 12.C may provide slightly more risk-adverse definitions of the overfishing threshold, they are arbitrary and potentially erroneous, especially when the available data are considered. In summary, Proposed Alternative 12.A is the most scientifically defensible definition.

Finally, as shown in Figure 7 of MSAP (2001a), F values have rarely approached F_{MSY} since the inception of management of this stock. Furthermore, using the point estimate probability as discussed herein, the cobia stock in the Gulf would currently not be considered as undergoing overfishing. Finally, as discussed above, landings have generally been below the Council's preferred F_{OY} yield.

Biological Impacts: As previously discussed, the setting of a definition of the overfishing threshold (MFMT) would not result in either positive or negative biological impacts; however, management measures that would be required to keep F values at or below any of the aforementioned MFMT proxies could have biological implications. As noted by Williams (2001) and MSAP (2001a) existing management measures appear to be controlling F at a level that is below F_{MSY}, and landings have generally been below equilibrium yield values throughout

the history of management of cobia (see Table 3 and Table 6). The stock is currently being fished at a level well below even the F_{OY} recommendation of $0.75*F_{MSY}$.

Although the cobia stock in the Gulf is currently not undergoing overfishing based on the current and recent F values and catches relative to equilibrium yield (Figure 7 of MSAP 2001a), the Council is required to set a overfishing threshold (MFMT) definition that should be no higher than F_{MSY}. Proposed Alternative 12.A and Alternatives 12.B, and 12.C set MFMT = F_{MSY}. As previously noted, Alternative 12.D would be even more risk prone, allowing a higher F and an expected lower SSB at equilibrium (Table 6). Alternative 12.E would allow F to approximately coincide with F_{MSY} before overfishing would be declared. Proposed Alternative 12.A is also consistent with the Council's preferred alternative for MSY as the yield associated with F_{MSY}.

Socioeconomic Impacts: MFMT is basically a biological concept, but it does provide the tone for setting management measures that have implications on both the stock and its exploitation by various user groups. If current fishing mortality exceeds the chosen threshold for a given probability, the stock would be considered to be undergoing overfishing, and regulatory measures have to be implemented to arrest overfishing. Proposed Alternative 12.A, Alternative 12.B and Alternative 12.C differ only in the choice of probability level. As may be expected, the lower the probability criterion, the higher is the likelihood for the stock to be declared as undergoing overfishing. As per results of the most recent stock assessment, the cobia stock is considered as not undergoing overfishing, so that no potentially more restrictive regulations would be adopted. Considering the relatively low landings in more recent years, adoption of more restrictive regulations may not be binding unless they are designed to be extremely restrictive. It appears that at present the adoption of more restrictive regulations would only reduce socioeconomic benefits that may not be totally outweighed by benefit increases in the future. If effort picks up in the future, the 50% probability level may be exceeded, but only then would more restrictive regulations be needed. In a sense, the 50% probability level minimizes the adoption of restrictive regulations but perhaps provides an adequate warning system for adoption of such regulations in the future.

Alternatives 12.D, 12.E, and and 12.F utilize SPR proxies for MFMT. Alternatives 12.D and 12.E, respectively, provide for higher and lower fishing mortality threshold than the currently approved $F_{30\%SPR}$ with assumed probabilities at 50%. Alternative 12.E offers almost the same threshold as the Proposed Alternative 12.A, and both are more conservative than the status quo Alternative 12.F. These alternatives would have no socioeconomic implications because current F values are below any of the other alternatives, but the resulting regulatory measures if the threshold is exceeded may be more restrictive.

Action 13: Overfished Threshold Alternatives (MSST)

Proposed Alternative 13.A: Set the minimum stock size threshold (MSST) at $(1\text{-}M)*B_{MSY}$ or 70% of B_{MSY}. The cobia stock in the Gulf of Mexico will be

considered overfished if the probability that $B_{current}$ is less than MSST is greater than 50%.

<u>Alternative 13.B</u>: Set the MSST at (1-M)*B_{MSY} or 70% of B_{MSY}. The cobia stock in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 40%.

<u>Alternative 13.C</u>: Set the MSST at (1-M)*B_{MSY} or 70% of B_{MSY}. The cobia stock in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 30%.

<u>Alternative 13.D</u>: Set the MSST at (1-0.5)*B_{MSY} or 50% of B_{MSY}. The cobia stock in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 50%.

<u>Alternative 13.E</u>: Set the MSST at (1-0.5)*B_{MSY} or 50% of B_{MSY}. The cobia stock in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 40%.

<u>Alternative 13.F</u>: Set the MSST at (1-0.5)*B_{MSY} or 50% of B_{MSY}. The cobia stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 30%.

<u>Alternative 13.G</u>: Status Quo - no action.

<u>Discussion and Rationale</u>: The MSST alternatives listed above are the same as those discussed for Gulf group Spanish mackerel under Action 9. The discussion of the requirements of the M-SFCMA and the guidance of the Guidelines for National Standard 1 (50 CFR Part 600.310) that are discussed in the first paragraph of the "discussion and rationale" for Action 9 are also applicable to cobia. These discussions are not repeated here, but are incorporated by reference. Much of the discussion and rationale for the Proposed Alternative 13.A and the comparisons with the other alternatives listed above are repeated from Action 9 for Gulf group Spanish mackerel in the following discussions for cobia because of the similarities in their effects of each of these stocks.

Like Gulf group Spanish mackerel, cobia are a relatively short-lived species that grows rapidly and matures early (maximum age at approximately 12 years [Franks et al. 1999]). Williams (2001) evaluated M at 0.2, 0.3, and 0.4; however, MSAP (2001a) believed that based on the life history of cobia as briefly noted above, the best estimate was M=0.3. Consequently, based on the recommendations from NMFS, MSST would be 70% of B_{MSY}. Proposed Alternative 13.A, and Alternatives 13.B and 13.C use this MSST proxy and incorporate probabilities of 50%, 40%, and 30%, respectively, that the current spawning stock biomass, as determined by the most recent stock assessment ($B_{CURRENT}$), is less than B_{MSY} for the overfished threshold. Alternatives 13.D, 13.E, and 13.F would set MSST at 50% of B_{MSY} which is the lowest biomass allowed by

the M-SFCMA, with the 50%, 40%, and 30% probabilities that $B_{CURRENT}$ is less than MSST, respectively. As previously discussed under Actions 5 and 9, there is a potential range of possible MSST values between 50% and 100% of B_{MSY} that could potentially be approved under the strict interpretation of the M-SFCMA. However, such designations other than the alternatives presented above would have no basis in biology or in legal guidance from the M-SFCMA or regulations, thus they would be arbitrary. Because of the disapproval of the Council's previously submitted definition of MSST by NMFS, Alternative 13.G (status quo) would result in there not being a definition for the overfished condition of the cobia stock in the Gulf as required by the National Standard Guidelines (50 CFR 600.310). This alternative is included solely for the purpose of compliance with NEPA.

Alternative 13.C is the most risk-adverse alternative for MSST incorporating only a 30% reduction in spawning stock biomass below B_{MSY} and the requirement of no more than a 30% chance that the estimate of $B_{CURRENT}$ is less than MSST before the overfished state is assumed. On the other hand, Alternative 13.D is the most risk-prone setting MSST at 50% of B_{MSY} and using a 50-50 chance that the estimate of $B_{CURRENT}$ is less than MSST before the overfished state is determined. The other alternatives can be scaled from more risk-adverse to more risk-prone in the following order: Alternative 13.B, Proposed Alternative 13.A, Alternative 13.F, and Alternative 13.E. This order occurs because using 70% of B_{MSY} for MSST as opposed to 50% provides far less risk regardless of the probabilities associated with the MSST estimate itself. The alternatives for variations in probability (30%, 40%, and 50%) for a given MSST level provide very little change in risk. In other words, Alternative 13.C is not substantially more risk-adverse than Proposed Alternative 13.A; however, both are significantly more risk-adverse than Alternatives 13.D, 13.E, and 13.F.

As stated by Williams (2001) "the choice of natural mortality (M) appears to greatly influence the perceived status of the (cobia) population." The reason why there is a substantial difference in risk between MSST =50% of B_{MSY} (Alternatives 13.D, 13.E, and 13.F) and MSST =70% of B_{MSY} (Proposed Alternative 13.A and Alternatives 13.B and 13.C) is that these sets of alternatives in essence change the value of M in the stock assessment from 0.3 to 0.5. Williams (2001) evaluated 3 different values (M=0.2, M=0.3, and M=0.4) and noted that at M=0.2 the stock would be considered depleted; at M=0.3 it would be near B_{MSY}; and at M=0.4 it would be well above B_{MSY}. Consequently, Proposed Alternative 13.A and Alternatives 13.B and 13.C only vary risk around a M value equal to 0.3; whereas Alternatives 13.D, 13.E, and 13.F totally change the MSST threshold and allow the stock to be reduced by 50% or its MSY as opposed to 70% before the overfished condition would be declared. Thus Alternatives 13.D, 13.E, and 13.F are much more risk-prone.

In recommending the Proposed Alternative 13.A, the Council accepted the technical advice of the NMFS and its scientific advisory panels that MSST be set at (1-M) * B_{MSY}, thus the cobia stock in the Gulf would be declared as overfished if the spawning stock biomass is reduced to below 70% of B_{MSY}. Although using a 40% or a 30% probability with regard to this estimate as in Alternatives 13.B and 13.C may be slightly more precautionary, the Council determined that the 50% probability associated with the MSST was the best point estimate.

Biological Impacts: As with the alternatives for definitions of MSY, OY, MFMT, and MSST discussed in this and previous actions above, the setting of a definition for the overfished threshold (MSST) for cobia would not result in either positive or negative biological impacts; however, management measures that would be required to rebuild the stock to B_{MSY} if it was reduced to below MSST would cause biological impacts, depending on the MSST definition chosen. As stated by Williams (2001), the only statement of certainty with regard to the population of cobia in the Gulf is that it has grown since the 1980s. Currently, MSAP (2001) estimated B_{2000}/B_{MSY} at 133%. Consequently, the stock would not be considered as overfished under any of the alternatives for MSST. Furthermore, using a MSST definition of 1-M * B_{MSY}, there was a only a 30% chance that the stock would be considered as overfished.

As previously noted management measures based on the level of F relative to MFMT are most important in preventing the overfished condition from occurring. Williams (2001) indicated that the increase in the cobia population noted above could be attributed to management measures, including the 33 inch FL minimum size limit and 2-fish bag limit (commercial and recreational) that were implemented in 1983 and 1990, respectively. Williams (2001) also noted that the trend in F has been fairly stable since 1980 with perhaps a decrease in recent years. These measures may also be responsible for helping maintain this relatively stable F over time.

Socioeconomic Impacts: MSST is basically a biological concept, but the current choices for MSST have significantly different socioeconomic implications when taking into account the associated management measures. The first 3 alternatives set MSST at the same level relative to B_{MSY} but at different probability levels. In the same vein, the next 3 alternatives set MSST at the same level (though different from that of the first 3 alternatives) with different probability levels. In general, the higher percentage level chosen for MSST relative to $B_{MSY,}$ such as the case with the first 3 alternatives, the higher is the likelihood that current biomass would fall below the threshold, thus resulting in the adoption of more stringent measures to rebuild the stock to B_{MSY}. Also, the lower the probability criterion chosen, the higher is the likelihood that current biomass would fall below the threshold as to require more stringent regulations.

Given the current cobia spawning stock size (133% SS_{MSY}) and that the probability of current spawning stock size being less than 70% of B_{msy} is about 30%, the stock is not considered overfished under any of the alternatives. Lower MSST thresholds, such as Alternative 13.D would generally allow a larger harvest, which produces larger short-term socioeconomic benefits. However, such thresholds would also increase the risk of a possible future stock collapse and may eventually require a gradual reduction in the allowable harvest, with the attendant socioeconomic disruption. Setting MSST at a relatively high level, such as the case with Alternative 13.C, would produce stability in year-to-year harvest, but could also result in large negative short-term socioeconomic impacts from the relatively large forgone yields.

Although the general implications of the various alternatives for MSST have been pointed out, the choice of which alternative provides the best balance between conservation benefits and adverse socioeconomic impacts cannot be ascertained. This lack of clear choice is partly a

function of the lack of probability with each MSST alternative that at that level the stock would be "actually" overfished and the associated rebuilding strategy would be successful in meeting the target MSY. For example, if all MSST alternatives have an equal probability of being "correct" such that the associated rebuilding paths would successfully rebuild the stock within 10 years, a lower MSST level which, as discussed above, associated with lower adverse socioeconomic impacts would be economically superior over others. As implied, however, in the "Biological Impacts" discussion, it appears that a higher MSST level has a higher probability of protecting the stock, whereas a lower MSST level is associated with a lower probability of protecting the stock. In this case, it would no longer hold true that a lower MSST level, which is associated with lower adverse socioeconomic impacts, would be economically better than a higher MSST level, since it is associated with lower probability that future benefits would accrue.

Private and Public Costs

The preparation, implementation, enforcement, and monitoring of this or any federal action involves the expenditure of public and private resources that can be expressed as costs associated with the regulations. Costs associated with the specific actions described herein include:

Council costs of document preparation, meetings, public hearings, and information dissemination	$55,000
NMFS administrative costs of document preparation, meetings and review	35,000
Permits costs	none
Enforcement costs	none
TOTAL	$90,000

The Council and Federal costs of document preparation are based on staff time, travel, printing, and any other relevant items where funds were expended directly for this specific action. There are no permit requirements proposed in this amendment. To the extent that there are no quota closures proposed in this amendment or other regulatory measures, except the setting of TAC, no additional enforcement activity is anticipated. In addition, under a fixed budget, any additional enforcement activity due to the adoption of this amendment would mean a redirection of resources to enforce the new measures.

Determination of a Significant Regulatory Action

Pursuant to E.O. 12866, a regulation is considered a "significant regulatory action" if it is likely to result in: (a) an annual effect on the economy of $100 million or more; (b) a major increase in costs or prices for consumers, individual industries, Federal, State, or local government agencies, or geographic regions; (c) significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of United States-based enterprises to compete with foreign-based enterprises in domestic or export markets; or (d) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order.

The only set of measures that may create direct economic impacts on fishing participants pertains to the setting of TAC for Gulf group king mackerel. All the other measures provide for reference points and status criteria for Gulf group king and Spanish mackerel and cobia. These measures set the tone for consideration and implementation of future management actions, but at present they do not establish regulatory measures affecting activities of fishing participants. In the event that regulations are considered in the future, their impacts on fishing participants will be analyzed at that time.

The preferred TAC alternative for Gulf group king mackerel is to maintain status quo TAC of 10.2 MP. In this case, this measure does not introduce a change in the economic performance of fishing participants. In addition, the entire Gulf commercial king mackerel harvest sector has an ex-vessel value of approximately $4.25 million. Thus, this regulatory amendment is not expected to create economic impacts of $100 million or more annually.

By maintaining status quo TAC, no major change in cost or prices would occur other than those that may be introduced by fishing and market conditions. In addition, there would be no effects on competition, employment, investment, productivity, innovation, or on the ability of U.S.-based enterprises to compete with foreign-based enterprises, since the operations of these vessels remain unaffected. Costs to the local and federal governments associated with the measures in this amendment are estimated at $90,000, and are due mainly to the preparation of this amendment.

Maintaining the status quo TAC for Gulf group king mackerel and the measures that establish reference points and status criteria do not interfere or create inconsistency with an action of another agency, including state fishing agencies, or affect any entitlements, grants, user fees, or loan programs. In fact the setting of status criteria is expected to comply with federal laws and guidelines requiring the establishment of such status criteria. All the measures considered in this amendment do not raise novel legal or policy issues, since these measures have been considered in the past and are being considered for other fisheries in the Gulf.

Since none of the indicators listed above would significantly change under this regulatory amendment, implementation of the proposed actions herein, would not constitute a significant regulatory action.

Regulatory Flexibility Act Analysis

Introduction

The purpose of the Regulatory Flexibility Act (RFA) is to establish a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration. The RFA does not contain any decision criteria; instead the purpose of the RFA is to inform the agency, as well as the public, of the expected economic impacts of various alternatives contained in the FMP or amendment (including framework management measures and other regulatory actions) and to ensure that the agency considers alternatives that minimize the expected impacts while meeting the goals and objectives of the FMP and applicable statutes.

With certain exceptions, the RFA requires agencies to conduct an Initial Regulatory Flexibility Analysis (IRFA) for each proposed rule. The IRFA is designed to assess the impacts various regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those impacts. In addition to analyses conducted for the Regulatory Impact Review (RIR), the IRFA provides: (1) a description of the reasons why action by the agency is being considered; (2) a succinct statement of the objectives of, and legal basis for, the proposed rule; (3) a description and, where feasible, an estimate of the number of small entities to which the proposed rule will apply; (4) a description of the projected reporting, record-keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirements of the report or record; and, (5) an identification, to the extent practicable, of all relevant Federal rules, which may duplicate, overlap, or conflict with the proposed rule.\

The succeeding analysis is conducted to primarily determine whether the proposed action would have a "significant economic impact on a substantial number of small entities."

Description of the reasons why action by the agency is being considered: The purpose and need for the actions recommended in this regulatory amendment are set forth in Section II of this document. In summary, they are to provide appropriate definitions of benchmarks and status criteria for managed stocks (Gulf group king mackerel, Gulf group Spanish mackerel, and cobia), as required by law and applicable regulations, and to consider the need to modify TAC for Gulf group king mackerel. This particular section is incorporated here by reference.

Statement of the objectives of, and legal basis for, the proposed rule: The specific objectives of the proposed actions are also found in Section II of this document, and this section is incorporated here by reference. The objectives are basically the same as the purpose as stated above, and the legal basis for the rule is the M-SFCMA, particularly Sections 303 (a)(3) and 303 (a)(10), as well as regulations under 50 CFR 600.310.

Description and estimate of the number of small entities to which the proposed rule will apply: In the Gulf area, a total of 1,440 commercial mackerel permits have been issued. Of this number, 12 to 20 vessels participate in the gill net fishery. For the recreational sector in the Gulf, there are 113 for-hire vessels with coastal pelagics permits only and 1,403 for-hire vessels with both reef fish and coastal migratory pelagic permits. A further description of all these affected vessels is provided below in the sections dealing with the substantial number and significant economic criteria.

Description of the projected reporting, record-keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for the preparation of the report or records: The proposals for establishing benchmarks and status criteria for managed stocks as well as TAC setting considerations in this amendment do not require additional reporting, record-keeping, or other compliance requirements. As noted earlier, the enforcement activity under this amendment may be considered part of the routine enforcement activities, given a fixed enforcement budget.

Identification of all relevant Federal rules, which may duplicate, overlap or conflict with the proposed rule: No duplicative, overlapping, or conflicting Federal rules have been identified. Section VI discusses "Other Applicable Laws", but none are considered to be duplicative, overlapping, or in conflict with those that would implement the proposed regulations. This amendment is similar in most respects to those considered or completed for other fisheries in the Gulf.

Substantial Number of Small Entities Criterion

The Small Business Administration (SBA) defines a small business in the commercial fishing activity as a firm with receipts of up to $3.5 million annually. The SBA also defines a small business in the charter boat activity as a firm with receipts of up to $6 million per year.

Unlike the case with the commercial reef fish fishery, there has been no cost and returns survey conducted on the mackerel fishery since the 1980's. However, the cost and returns surveys conducted on the commercial reef fish sector in the Gulf (Waters 1996) and in the Keys (Waters et al. 2001) provide some characteristics of a limited number of hook-and-line vessels that participated in the commercial king mackerel fishery. Although this information is presented here, some caution has to be raised regarding the representativeness of the financial characteristics.

According to the surveys (Waters 1996 and Waters et al. 2001), the average annual gross receipts for fishing vessels when king mackerel provided the greatest trip revenues was $12,011 for Gulf vessels and $3,318 for Keys vessels. These are vessels that had at least one trip where king mackerel provided the greatest trip revenue. At the risk of being repetitive, it should be pointed out that these surveys were intended to collect financial information of vessels mainly

engaged in the reef fish fishery. The information collected regarding king mackerel arose as a by-product of the mentioned surveys of reef fish vessels. Given such condition, it is likely that these numbers are underestimates of gross receipts of vessels that primarily depend on king mackerel. For example, consider the 15 vessels that reported in their logbook submission for 2001 as having caught king mackerel using gillnets. These vessels caught their total allocation of 520,800 pounds. At a price per pound of $1.25, total revenues would amount to $651,000, implying that average revenue per vessel would be about $43,000. Of course, if these vessels' revenues are averaged together with revenues of smaller hook-and-line vessels, the average revenue per boat would substantially fall well below the average for net vessels. In fact, Vondruska (personal communication, 2003) estimated that net vessels' annual gross revenue had a mean of $41,000 and median ($50^{th}$ percentile) of $27,000, counting all logbook-reported commercial landings, regardless of species, area of capture, time or port of landing. The data set does not count any gross revenue from commercial fishing not reported via the NMFS-SEFSC southeast coastal fishery logbook system. Adding the mostly smaller vessels that caught Gulf group king mackerel with other fishing gear, notably hook-and-line gear, the total came to 750 vessels in the same year, and the gross revenue had a mean of $33,000 and a median of $11,000 ($10^{th}$ percentile, $1,700; 90^{th} percentile, $106,000). The maximums were roughly $350,000 to $500,000 in fishing years 1998/1999 to 2001/2002. In terms of contribution to estimated annual gross revenue, the vessels with gillnet landings appear to have been more dependent on their specified landings of Gulf group king mackerel than the larger group of vessels; 18% to 29% of gross in recent years versus 9% to 14% at the median.

Vondruska (1998) examined permit information and derived some estimates of gross receipts of vessels with commercial mackerel permits. Several statistical estimates were provided, and one feature that appears to stand out from the analysis is that permitted vessels in general participated in many fisheries. Presented below are estimated mean annual (1997) receipts of vessels with commercial mackerel permits (king mackerel ranked among the top four fish in value of sales) and homeported in Florida, Alabama, Mississippi, Louisiana and Texas. While these are geometric means, and numerically closer to medians than to arithmetic means given the statistical nature of the data, a note of caution applies to these as well as the preceding estimates.

Florida, east coast	$ 9,790
Florida, west coast	15,654
Florida, non-coastal	12,066
Alabama	19,965
Mississippi	18,746
Louisiana	26,550
Texas	22,996

There are about 1,516 for-hire vessels with permits to fish for coastal pelagics only or reef fish and coastal pelagics in the Gulf. Average lengths for charter boats are 47 feet in Alabama, 43 feet in Louisiana, 41 feet in Mississippi, and 35 feet in Texas. Headboats are approximately 72 feet in length from Alabama through Texas (Sutton et al., 1999). In Florida, charter boats have an average length of 37 feet and headboats, 62 feet. Based on fees, number of passengers and

number of trips, average annual receipts total $68,000 for charter boats and $324,000 for headboats in Florida (Holland et al., 1999).

The foregoing description of the vessels potentially affected by the proposed regulations shows that all the potentially affected businesses fall within the general definition of small business entities. Hence, it may be concluded that the criterion of a substantial number of the small business entities comprising the mackerel commercial and for-hire sectors affected by the proposed rule will be met. Therefore, all business entities that operate in the mackerel and cobia fisheries are classified as small business entities. Since all such businesses will be covered, the proposed rule will apply to a substantial number of small business entities.

Significant Economic Impact Criterion

The outcome of "significant economic impact" can be ascertained by examining two issues: disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All the business entities potentially affected by the proposed rule are considered small entities so that the issue of disproportionality does not arise in the present case. There are, however, some variations among fishing operations in terms of vessel revenues and size, as described above.

Profitability: Do the regulations significantly reduce profit for a substantial number of small entities?

Waters (1996) and Waters et al. (2001) reported net income of commercial mackerel vessels of $8,882 for Gulf vessels and $2,238 for Keys vessels. For the already mentioned set of vessels with commercial mackerel fishing permits, and counting data for 1,467 vessels with home ports in Atlantic and Gulf coast states, Vondruska (1998) computed a median for net income (taxable income) from fishing for vessel owners of $3,670. Since medians were not computed by state, the following estimates for net income are derived by subtracting the mean for fishing expense from the mean gross receipts for individual states:

Florida, east coast	$2,956
Florida, west coast	3,033
Florida, non-coastal	1,543
Louisiana	4,773

Information for Mississippi vessels is insufficient to determine net receipts. Vessels for Alabama and Texas show losses.

Sutton et al. (1999) reported net revenue figures of for-hire vessels in the Alabama-Texas area, but problems associated with the reporting of both costs and revenues in this survey prevent the

use of these estimates. Holland et al. (1999) provided no estimates for net revenue or profit for the for-hire vessels in Florida. Within a set of 1,920 vessels that had federal charter fishing permits in 1997 and home ports in Atlantic and Gulf coast states, Vondruska (1998) found 526 vessels had data for gross revenues from fishing (charter and commercial) and fishing expense, and estimated net income (taxable income) from fishing for vessel owners from these two values. The median for gross revenue from fishing was about $20,000 (10th percentile, $5,400; 90th percentile, about $86,000; 99th percentile, $220,000). The median value for net income was about $4,000 (10th percentile, -$10,000, i.e., fishing expense exceeded gross revenue from fishing; 90th percentile, $33,000; 99th percentile, about$90,000). The median length of vessel was 36 feet; main engine horsepower, 394. The set of boats with charter permits tended to be a bit longer and to have main engines with more horsepower than the set of boats with permits for commercial mackerel fishing (the two sets of boats are not mutually exclusive; some vessels are in both data sets).

Because the proposed alternatives in this amendment do not impose or relax existing management measures, it is unlikely that profits of commercial vessels would be reduced, because there would be no potential reductions in revenues and/or increases in costs, particularly because the proposed rule will accommodate current and foreseeable harvest performance in the commercial fishery. Likewise, the recreational sector would not be subject to reductions in harvests, and the for-hire fishery would not experience any reductions in profits.

Description of significant alternatives to the proposed rule and discussion of how the alternatives attempt to minimize economic impacts on small entities

Various alternatives to the proposed actions and their potential impacts are discussed at length under each of the actions in Section IV. These discussions are incorporated here by reference. As noted in discussions under Actions 2 through 13, there would be no economic impacts to small entities from the setting of benchmarks and status criteria for the managed stocks (Gulf group king and Spanish mackerel as well as cobia). However, to the extent that any of the chosen status criteria would not allow a sufficiently liberal harvest of any of these stocks, there is the potential that future regulations designed to control the commercial and recreational sectors their respective allocations would impact commercial and for-hire vessel operations. Once proposed, these additional regulations will be analyzed with regard to their impacts on small business entities. It should be noted, however, that as discussed in Section IV, the choice of preferred alternatives attempt to balance the long-term viability of the stocks and consequent short- and long-term socioeconomic impacts. Considering present and foreseeable level of harvest for king mackerel, Spanish mackerel and cobia, the chosen preferred alternatives provide for no immediate change in regulations. The subject then of minimizing adverse impacts on small entities does not constitute a major issue.

The choice for king mackerel TAC is the issue that has direct bearing on the operations of small business entities. Alternatives for TAC range from 5.2 MP to 10.2 MP. The preferred alternative is in fact the highest TAC alternative, and considering that it is also the status quo TAC, no impacts on small business entities may arise from selecting the preferred alternative.

All other alternatives provide for lower TACs and thus would have the likely result of adversely affecting small business entities, particularly in the commercial sector. To the extent that the recreational sector is regulated through bag and size limits with no quota closure, any of the alternatives would not have immediate impacts on small entities. However, alternatives other than the one proposed by the Council would likely require more stringent regulations in the near future, especially if effort in the recreational fishery increases in the future. Given this consideration, the Council's preferred alternative for Gulf group king mackerel TAC would provide the least, if any, disruption on the operations of small entities.

Conclusion

The measures considered in this amendment are expected to meet the criterion for affecting a substantial number of small entities, but not the significant economic impact criterion. Therefore, it is concluded that the proposed regulation, if adopted, would not have a significant economic impact on a substantial number of small entities. An IRFA is, therefore, not required. The Regulatory Flexibility Act Analysis in this section provides full disclosure based on the data currently available. If and when additional regulations are proposed in the future, the analysis of those impacts will be done at that time.

V. ENVIRONMENTAL CONSEQUENCES

This section reviews and discusses the effects of the proposed actions on the biological, physical, social, and economic environment of the Gulf group king and Spanish mackerel fisheries of the Gulf of Mexico. These reviews and discussions are part of the Environmental Assessment (EA) that has been incorporated throughout this document to determine whether there is a significant environmental impact on the Human Environment that would result in the need to develop a SEIS. The Human Environment, as defined by §1508.14 of the CEQ regulations is "interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment."

Biological Environment

The Coastal Migratory Pelagic Resources FMP (with EIS), various amendments, and the Generic EFH Amendment provide a review of the biology and habitat of king mackerel, Spanish mackerel and cobia, and they are incorporated here by reference. A summary of the biological environment of Gulf group king mackerel, Gulf group Spanish mackerel, and cobia are provided in the following.

King Mackerel - King mackerel are a marine pelagic species that is found throughout the Gulf of Mexico from shore to 200 m depths. Adults are known to spawn throughout the Gulf in areas of low turbidity, and salinity and temperatures of approximately 30 parts per thousand (ppt) and 27°C, respectively with potentially major spawning areas off Louisiana and Texas (McEachran and Finucane 1979). Spawning occurs generally from May through October with peak

spawning in September (McEachran and Finucane 1979). Eggs and larvae are pelagic over depths of 30 to 180 m, and larvae may descend to mid depths during the day. Juveniles are generally found closer to shore at inshore to mid shelf depths (to < 9 m) and occasionally in estuaries. Adults are migratory, and the Coastal Migratory Pelagics FMP recognizes two migratory groups (Gulf and Atlantic) that are shown in Figure 1 herein. Typically, adult king mackerel are found in the southern climates (south Florida and extreme south Texas/Mexico) in the winter and in the northern Gulf in the summer. Food availability and water temperature are likely causes of these migratory patterns. King mackerel mature at approximately age 2-3 and have longevities of 18 years for females and 23 years for males (GMFMC/SAFMC 1985, MSAP 1996). Gulf group king mackerel primarily eat other fish species (herring, sardines, and menhaden) and to a lesser extent squid at all life stages (larvae to adult). In turn they are eaten primarily by larger pelagic predators, e.g., sharks.

Spanish Mackerel - Spanish mackerel are pelagic, occurring over depths to 75 m throughout the coastal zone of the Gulf of Mexico. Adults usually are found in neritic waters and along coastal areas. They will inhabit estuarine areas, especially the higher salinity areas, during seasonal migrations, but are considered rare and infrequent in many Gulf estuaries. Spawning occurs along the inner continental shelf of the northern Gulf from May to October. Eggs and larvae occur most frequently offshore over the inner continental shelf at temperatures between 20°C to 32°C and salinities between 28 ppt and 37 ppt. They are also most frequently found in water depths from 9 to about 84 m, but are most common in < 50 m. Juveniles are most often found in the northern Gulf in coastal and estuarine habitats and at temperatures >25°C and salinities >10 ppt. Although they occur in waters of varying salinity, juveniles appear to prefer marine salinity levels and generally are not considered estuarine dependent. Like king mackerel, adult Spanish mackerel are migratory, generally moving from wintering areas of south Florida and Mexico to the northern Gulf in spring and summer. Spanish mackerel generally mature at age 1-2 and have a maximum age of approximately 7 years for females and 10 years for males. Like Gulf group king mackerel, Spanish mackerel primarily eat other fish species (herring, sardines, and menhaden) and to a lesser extent crustaceans and squid at all life stages (larvae to adult). They are eaten primarily by larger pelagic predators, e.g., sharks, tunas, and bottlenose dolphin.

Cobia - Cobia are found throughout the coastal waters of the Gulf. The species is large, pelagic, and epibenthic and is often found near wrecks, reefs, pilings, buoys and floating objects. Greatest abundance is in the coastal areas from shore to 20 m depths in the eastern Gulf, 40 m in the northern Gulf and to 100 m in the southern Gulf. Adults are most common in nearshore and coastal waters off northwestern Florida to Texas from March through October and in south Florida from November through February, although some fish overwinter in the northern Gulf at depths of 100-125 m (Franks et al. 1999, Williams 2001). Cobia are batch spawners with spawning occurring from April to September in nearshore and shelf waters of the northern Gulf. Eggs are pelagic, usually found in the top meter of the water column in the summer at temperatures of 28°C to 29°C and salinities of between 30 to 34 ppt. Larvae are found from May to September in estuarine and offshore shelf waters of the northern Gulf from the surface to depths of 300 m and at temperatures of 24°C to 32°C and salinities as low as 19 ppt. Pre- and early juveniles occur in April-July in coastal waters and the offshore shelf in the northern Gulf.

Late juveniles are found May-October in coastal waters and the offshore shelf, with both stages occurring in salinities and temperatures similar to larvae. Cobia begin maturing at age 1 for males and age 2 for females and all are mature by age 4. Maximum age has been estimated at 14 years for males and 13 years for females. Larvae and juveniles feed on a variety of zooplankton and including small fish and crustaceans while adults while adults feed primarily on demersal organisms such as crabs, shrimp, and eels (although they will eat other fish as well). The predators of cobia have not been reported in available literature, but they are presumably eaten by larger pelagic fishes. Dolphin (*Coryphaena hippurus*) have been reported to prey upon small cobia (Rose 1965)

The biological impacts of the proposed and rejected alternatives for each of the 13 actions are discussed immediately following each set of alternatives for each action in Section IV and are incorporated here by reference. A brief summary of these biological impacts is included below.

As noted for Action 1, there should be no additional biological impacts from retaining the current TAC at 10.2 MP (Proposed Alternative 1.F); however, because the Gulf group king mackerel stock has not yet fully recovered to B_{MSY} a lower TAC would be expected to expedite such recovery, if it is being taken. Alternatives 1.A and 1.C (9.8 MP and 9.5 MP TAC, respectively) would probably not change the biological impacts because catch levels under existing regulations have not produced this harvest and only the commercial sector would be affected. Alternatives 1.B, 1.D, and 1.E would produce significant reductions in catch for the commercial sector because this sector operates under a quota, and the fishery is closed when the quota is caught. On the other hand, the recreational harvest is governed by bag and size limits, and its allocation is not monitored as a quota nor is the fishery closed. Consequently, recreational catches would not be affected by any of the other alternatives for TAC reduction. Since the recreational sector is allocated 68% of the annual TAC, a 33% reduction in TAC as with Alternative 1.D would only produce a 11% overall reduction which would come out of the commercial allocation (and this is the only alternative that would potentially result in recreational catches exceeding the recreational allocation). A 28% reduction in TAC as with Alternative 1.E would only produce a 9.1% overall TAC reduction, again from the commercial sector. Alternatives 1.B would produce reductions between these ranges. Also, as previously discussed, a reduction in TAC is not needed because the stock is not overfished, the spawning stock size is building to B_{MSY} and B_{OY}, and the current 10.2 MP TAC is equal to the OY recommendation when the stock is at equilibrium.

As discussed in Section IV, the setting of MSY, OY, MFMT, and MSST definitions would not of themselves create biological impacts or affect the biological environment in any way. Using the yield at $F_{30\%SPR}$ as a MSY proxy for Gulf group king and Spanish mackerel as in Actions 2 and 6 appears to be the most biologically justifiable based on advice from various scientific reviews including Mace et al. 1996, and various reports of the MSAP and Scientific and Statistical Committee (SSC). Alternatives that would allow fishing at a higher F would have a higher potential yield, but would increase the potential for overfishing. On the other hand, although alternatives for yields at a lower F would reduce the risk of overfishing, they would produce lower yields. Since the management target set by the M-SFCMA is OY, the preferred

alternatives for setting the OY proxy at the yield associated with 0.85 * F_{MSY} for Gulf group king mackerel and 0.75 * F_{MSY} for Gulf group Spanish mackerel (Actions 3 and 7) provide these stocks with increased protection from negative biological impacts because the stocks are allowed to build to higher levels than needed to produce MSY. Furthermore, as shown in Tables 4 and 5, these OY definitions provide sufficient cushion in equilibrium yields and biomasses as recommended by Restrepo et al. (1998) and take into consideration the differences in the life history of each species.

The MFMT thresholds for Gulf group king and Spanish mackerel are set at $F_{30\%SPR}$ (Actions 4 and 8) to correspond with achieving the MSY yield. Again, these F values are the most biologically justifiable based on advice from various scientific reviews as stated above and as required by National Standard 1 of the M-SFCMA. Furthermore, they are consistent with the definition of overfishing as defined by the M-SFCMA that identifies overfishing as a F that would jeopardize the capacity of a stock to produce MSY on a continuing basis. Because OY is the target, current management measures and fishing mortality rates for these stocks are producing F values that are lower than these thresholds. However, these threshold definitions for MFMT are most appropriate as a biological trigger for additional management measures if such are determined to be needed in the future.

The proposed MSST levels for Gulf group king and Spanish mackerel (Actions 5 and 9) set the overfished threshold at 1-M*B_{MSY} or 80% and 70%, respectively. These levels are consistent with the biological advice from NMFS and from the Council's scientific advisory panels. They are also much more conservative and risk-adverse than other alternatives that would be allowed by the M-SFCMA that could set MSST at 50% of B_{MSY}. Although these MSST definitions are important to determine when a stock is overfished and a rebuilding plan would be needed, the control of F through appropriate management measures is the most important management consideration from a biological perspective in order to prevent this condition from occurring.

There is significantly less biological information on cobia for use in establishing MSY, OY, MFMT, and MSST definitions; however, National Standard 2 of the M-SFCMA requires the use of the best available scientific information. To reiterate, the setting of these definitions would not create any impacts on the biological environment. Williams (2001) estimated MSY directly in his modeling efforts, and the Council's scientific advisory panels (MSAP 2001a, and SSC) determined that this estimate was more appropriate than the use of F at some SPR percentage, thus the Council selected Proposed Alternative 10.A as the best estimate of MSY for Action 10. For OY, the Council agreed with NMFS recommendations and set OY equal to 75% of MSY. Consequently, such definition would have a lower F value and a lower harvest level. As shown in Table 6, this choice of OY would produce a lower F value and higher spawning stock biomass than the $F_{40\%SPR}$ that was chosen for Gulf group king and Spanish mackerel, thus reducing risks to the biological environment. Furthermore, Table 3 shows that in recent years catches have been below the proposed OY level.

Because MSY yield was estimated directly from a F_{MSY}, it is logical that the best scientific estimate of MFMT would be an estimated $F_{CURRENT}$ value that exceeds F_{MSY}. Because current

estimates of F (and catches as shown in Table 3) are below the proposed MFMT, there is little risk of negative impacts to the biological environment of cobia. As discussed above for Spanish mackerel the choice of a MSST value base on 1-M*B_{MSY} or 70% of B_{MSY} is far more conservative than the allowable 50% of B_{MSY}. The same is true for cobia, and as discussed above this choice of an overfished definition is the most scientifically defensible in determining when this condition would occur.

Physical Environment

The alternatives proposed in this amendment should not have any impact on the physical environment. Because none of the stocks are considered as overfished or undergoing overfishing, the only actions being taken are to establish benchmarks and status criteria for Gulf group king and Spanish mackerel and cobia. These actions do not include any changes to management measures previously instituted including allowable gear, bag limits, trip limits, size limits, closed areas or seasons, quotas, etc. Therefore, there should be no change in fishing practices by fishermen. Approximately 95% of the harvest of Gulf group king mackerel is by trolled or casted (rod-and-reel) lines with approximately 5% of the harvest from run-around gill nets. Gulf group Spanish mackerel and cobia are almost exclusively harvested with trolled or casted (rod-and-reel) lines. All three species are migratory and schooling fish, with Gulf group king and Spanish mackerel forming larger schools than cobia. Additionally, they are primarily found at or near the surface. Consequently, the gears used do not contact the bottom where there is the potential for damage to coral and other benthic habitat as discussed by Barnette (2001). Although Barnette (2001) noted that fixed gill nets can have minor impacts to the bottom (primarily corals) and if lost can produce "ghost fishing", run-around gill nets are retrieved very soon after a set. Consequently, they are not lost. Furthermore, because of the small harvest allowed by gill nets, this fishery only operates with approximately 12-20 vessels and the season usually lasts only a few days.

Effect on Wetlands: From the discussions in Section IV, Amendment 1 to the Coastal Migratory Pelagics FMP (GMFMC/SAFMC 1985), the Council's Generic EFH Amendment (GMFMC 1998), it has been determined that the proposed and rejected alternatives regarding Gulf group king mackerel, Gulf group Spanish mackerel and cobia status criteria and bench marks, as well as TAC for Gulf group king mackerel would have no effect on flood plains, rivers, creeks, or other streams and tributaries to the marine environment or their associated wetlands because no actions are proposed in these areas.

Effect on Essential Fish Habitat: As stated above, the discussions and evaluations of the alternatives under each of the Actions 1-13 in Section IV, Amendment 1 to the Coastal Migratory Pelagics FMP (GMFMC/SAFMC 1985), and particularly the Council's Generic EFH Amendment (GMFMC 1998) indicate that the proposed and rejected alternatives regarding Gulf group king mackerel, Gulf group Spanish mackerel and cobia status criteria and bench marks, as well as TAC for Gulf group king mackerel would have no effect on EFH. Following submission of this document for implementation, NMFS will confer with their Habitat Conservation Division (HCD) to insure that these actions would not have an impact on EFH, and will then make a final determination regarding potential effects to EFH. If the final determination is that the proposed actions would have no adverse effects on EFH, then no EFH consultation is

required. If after conferring with HCD, NMFS determines that the proposed actions would result in potential adverse effects to EFH, an EFH assessment will be prepared and an EFH consultation will be completed prior to final action being taken.

Mitigating Measures: No mitigating measures related to the proposed actions are necessary because the actions to set status criteria and benchmarks for Gulf group king mackerel, Gulf group Spanish mackerel and cobia, and to set a TAC for Gulf group king mackerel would not result in any harmful affects to the environment, as discussed above.

Unavoidable Adverse Effects: The proposed actions to implement status criteria and benchmarks for Gulf group king mackerel, Gulf group Spanish mackerel and cobia and setting of TAC for Gulf group king mackerel do not create unavoidable adverse effects on the environment. As discussed above, no environment impacts are expected from these actions.

Irreversible and Irretrievable Commitments of Resources: There are no irreversible commitments of resources other than costs of administering and enforcing the proposed rule resulting from implementation of this amendment. Implementing status criteria for Gulf group king mackerel, Gulf group Spanish mackerel and cobia and setting a TAC for Gulf group king mackerel should not increase the cost or reduce the revenues of affected vessels/boats, nor change the cost and revenue configurations of affected vessels/boats. The commitment of resources to implement the status criteria and setting a TAC does not involve huge financial considerations that need to be fully recouped over a certain period of time.

Relationship Between Short-Term Uses and Long-Term Productivity: While the short-term uses of these fisheries should not be affected by the implementation of the status criteria for Gulf group king mackerel, Gulf group Spanish mackerel and cobia and TAC for Gulf group king mackerel, long-term productivity should benefit. This benefit would result from having established, measurable criteria upon which to gauge whether overfishing is occurring and to take corrective actions prior to any of these stocks becoming overfished. Consequently, these actions should provide greater stability to these fisheries in the long run.

Impacts on Other Fisheries: The proposed actions to implement status criteria and benchmarks for Gulf group king mackerel, Gulf group Spanish mackerel, and cobia would not have any impacts on other fisheries because these measures only establish definitions and do not impose management measures. The setting of TAC for Gulf group king mackerel would also not impact other fisheries because this action only establishes an allowable level of harvest. To the extent that management measures currently in place impact the population either positively or negatively, there could be minor impacts based on ecological relationships, primarily predator/prey relationships. As previously discussed most of the known food sources for Gulf group king and Spanish mackerel include unmanaged species such as sardines, herrings, and menhaden (although menhaden are managed by a season in state waters of the northern Gulf). Cobia feed on crustaceans that could include stone crab, blue crab and spiny lobster, but their impact to these stocks is probably

minimal compared to environmental factors and the directed fisheries. Although Gulf group king and Spanish mackerel and cobia are predators of other managed species, the interrelationships among them are not well known. To assess these relationships and determine levels of impacts, complex models would need to be developed. Currently, the only model for the Gulf of Mexico that could address these issues is the Ecopath model being developed by FMRI and NMFS. The development of this model is in the early stages and at present, the precision of the model is low (Mahmoudi, personal communication). The expense of collecting the additional data needed for this model would be exorbitant and the data would need to be collected over years to increase the precision of the results. Therefore, it would be impracticable to apply this model at this time. Furthermore, it is highly probable that any impacts would be minimal because the majority of these prey species (e.g., menhaden) are highly abundant.

Social and Economic Environment

Description of the Fishery: The original FMP and subsequent amendments, including accompanying Environmental Impact Statement (EIS), Supplemental Environmental Impact Statement (SEIS) or EA along with Section III and IV herein describe the coastal migratory pelagics fishery in the Gulf. See Section I herein for an overview of the management actions taken in the original Coastal Migratory Pelagics FMP and subsequent amendments. Review Section III for a synopsis of these fisheries and how they operate. Additional descriptions of the Gulf group king and Spanish mackerel and cobia fisheries are embedded in the socioeconomic impacts sections of this document.

History of Management: See Section I herein for a review of the management history of coastal migratory pelagics fishery in the Gulf of Mexico.

Economic and Social Assessment: The economic and social effects of the various actions in this amendment are discussed in detail in the discussions following each set of alternatives in Sections IV. These effects are specific for each set of management actions being considered.

Cumulative Impacts of Past and Proposed Actions

The Council on Environmental Quality (CEQ) regulations (40 CFR 1508.7) define cumulative impacts as "The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts could result from individually minor but collectively significant actions taking place over a period of time." Past actions on Gulf group king mackerel, Gulf group Spanish mackerel, and cobia are summarized in Section I and are incorporated here by reference. As discussed and as shown in Table 1 and Table 2 for Gulf group king and Spanish mackerel, there have been progressive changes in TAC, bag limits, trip limits, and other management measures. These changes have generally resulted in increasing TAC levels and recovery of these stocks from a once overfished condition to the present condition of not undergoing overfishing and not overfished. For cobia, Amendment 1 which set the minimum size limit at 33 inches FL and Amendment 5 which established a 2 fish per person bag limit are particularly important to the stability of this fishery since the inception of management. Cobia are also not considered to be overfished or undergoing overfishing, and the population in

the Gulf has increased since the 1980s with the most likely reason being the institution of these management regulations (Williams 2001). In summary, the cumulative impacts of past actions have had positive impacts on these stocks that have allowed them to recover from an overfished state or at least low population levels as with cobia. The proposed actions in this amendment would not change these impacts because they do not impose additional management restrictions nor do they remove any existing measures.

Finding of No Significant Environmental Impact (FONSI)

The Gulf of Mexico Fishery Management Council (Council) is submitting the attached Framework Seasonal Adjustment of Harvest Procedures, Reference Points, and Status Criteria under the Fishery Management Plan for Coastal Migratory Pelagic Resources in the Gulf of Mexico, including Environmental Assessment, Regulatory Impact Review, and Initial Regulatory Flexibility Act Analysis for Secretarial review under procedures of the Magnuson-Stevens Fishery Conservation and Management Act. This regulatory amendment was developed as an integrated document that includes an Environmental Assessment (EA), Regulatory Impact Review (RIR), and Regulatory Flexibility Act Analysis. Copies of the Amendment are available from the Council at the following address:

Gulf of Mexico Fishery Management Council
The Commons at Rivergate
3018 U.S. Highway 301 North
Suite 1000
Tampa, Florida 33619

Through this regulatory amendment, the Council proposes to: 1) set a TAC for Gulf group king mackerel and 2) specify MSY, OY, MFMT, and MSST levels to bring Gulf group king mackerel, Gulf group Spanish mackerel, and cobia into compliance with current fishery management standards.

The preferred alternative contained within this regulatory amendment for the 2003-2004 TAC for Gulf group king mackerel is the status quo TAC of 10.2 MP.

The preferred alternatives for SFA status criteria for Gulf group king mackerel are as follows:

Maximum Sustainable Yield (MSY) for Gulf group king mackerel is the yield associated with $F_{30\% \text{ SPR}}$ when the stock is at equilibrium (currently estimated at 10.7 MP).

Optimum Yield (OY) for Gulf group king mackerel is the yield associated with 0.85 * F_{MSY} when the stock is at equilibrium (currently estimated at 10.2 MP).

Set MFMT = $F_{30\%SPR}$ = F_{MSY}. The Gulf group king mackerel stock would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 50%.

Set the minimum stock size threshold (MSST) at (1-M)*B_{MSY} or 80% of B_{MSY}. Gulf group king mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 50%.

The preferred alternatives for SFA status criteria for Gulf group Spanish mackerel are as follows:

Maximum Sustainable Yield (MSY) for Gulf group Spanish mackerel is the yield associated with $F_{30\% SPR}$ when the stock is at equilibrium (currently estimated at 8.7 MP).

Optimum Yield (OY) for Gulf group Spanish mackerel is the yield associated with 0.75 * F_{MSY} when the stock is at equilibrium (currently estimated at 8.3 MP).

Set MFMT = $F_{30\%SPR}$ = F_{MSY}. The Gulf group Spanish mackerel stock would be considered undergoing overfishing if the probability that $F_{current}$ is larger than F_{MSY} is greater than 50%.

Set the minimum stock size threshold (MSST) at (1-M)*B_{MSY} or 70% of B_{MSY}. Gulf group Spanish mackerel stocks in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 50%.

The preferred alternatives for SFA status criteria for cobia are as follows:

Maximum Sustainable Yield (MSY) for the cobia stock in the Gulf of Mexico is the yield associated with F_{MSY} (currently estimated at 1.489 million pounds) when the stock is at equilibrium.

OY for the cobia stock in the Gulf of Mexico is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: F_{OY}=0.75 * F_{MSY} when the stock is at equilibrium (currently estimated at 1.452 MP).

Set MFMT = $F_{MSY.}$ The cobia stock in the Gulf of Mexico would be considered undergoing overfishing if the probability that $F_{CURRENT}$ is larger than F_{MSY} is greater than 50%.

Set the minimum stock size threshold (MSST) at (1-M)*B_{MSY} or 70% of B_{MSY}. The cobia stock in the Gulf of Mexico will be considered overfished if the probability that $B_{current}$ is less than MSST is greater than 50%.

Summary of Effects - Rationale

TAC Alternatives: The Council's proposed action is to retain the present TAC at 10.2 MP which is equal to the mid-point of the estimated $F_{30\%SPR}$ ABC range under the stock assessment model

that does not use the questionable additional age data (Ortiz et al. 2002). Furthermore, it is equal to the yield associated with fishing at 85% of MSY, the Council's proposed OY definition, when the stock is at equilibrium (Table 4). Additionally, F values in recent years have been below F_{MSY} and biomass continues to increase. The mid-point estimates of ABC for the MSY proxy of $F_{30\%SPR}$ calculated from 1999 to 2002 (10.1 MP, 10.2 MP, 11.1 MP and 9.8 MP, respectively) are similar to the current TAC, and within the range of the 20-80% confidence interval range for the Council's proposed F_{OY} . Consequently, the worst case scenario is that the stock size is approaching/transitioning toward the B_{MSY} and B_{OY} levels under the current management regime.

The Gulf group king mackerel stock would not be considered as overfished or undergoing overfishing based on the proposed status criteria; consequently, a TAC level in excess of the mid-point of the ABC range for OY is acceptable under 50 CFR Part 600.310 because catches are not meeting this level and the spawning stock biomass continues to increase. Furthermore, retaining TAC at 10.2 MP should provide the least disruptive harvest level for the commercial sector which is the only sector that would be affected by a reduction in TAC. Reducing TAC to any of the other alternatives would not produce a corresponding reduction in harvest of the same magnitude because as previously discussed only the commercial sector would be affected and the recreational sector is allocated 68% of the TAC. Retaining the TAC at 10.2 MP would also be considered conservative and precautionary because the effects of regulations requiring bycatch reduction devices (BRDs) in shrimp trawls and the increase in the minimum size limit for Gulf group king mackerel from 20 inches to 24 inches fork length (FL) that were approved in 1998 should further reduce fishing mortality, further increase spawning stock biomass, and increase recruitment. The effects of these measures have not been evaluated, and the majority of the fish affected by these regulations would only now be entering the fishery. Finally, the status quo TAC of 10.2 MP is consistent with the recommendations of the Council's Mackerel AP, SEP, and testimony from users; and recent years catches are over 2.0 MP below this recommended TAC. Consequently, maintaining the existing TAC would not result in any significant impacts to the biological, physical, or social and economic environments.

MSY Alternatives: In the Council's Generic Sustainable Fisheries Act Amendment, MSY for Gulf group king and Spanish mackerel as well as cobia was set at 30% static SPR. This value was determined by the Council to be the most appropriate based on recommendations of the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP (1997). The NMFS rejected this definition because it did not specify MSY in biomass units. In readdressing the definition of MSY for both Gulf group king and Spanish mackerel, the Council evaluated identical alternatives as discussed in Actions 2 and 6. These alternatives specify MSY in terms of the yield associated with a F for a range of SPR percentages. The Council also considered additional recommendations of its stock assessment panels in selecting the proposed alternative for MSY as the yield associated with $F_{30\% SPR}$. The Council believed that alternatives using higher SPR levels would result in overestimating MSY and could result in more restrictive management measures being required. Furthermore, the use of a lower SPR levels were determined to underestimate MSY and may not result in optimizing yield from a fishery which is the management target required by the M-SFCMA.

The MSY level for a given stock is based on the highest F value allowable when a stock is at equilibrium. Since the currently approved and proposed definition of MFMT is based on $F_{30\% SPR}$, it is logical that these definitions would be consistent, except for cobia. Furthermore, as discussed above these definitions are consistent with the current application of fishery management measures for both the Gulf group king and Spanish mackerel fisheries. Consequently, the proposed definition of MSY as the yield associated with fishing at $F_{30\% SPR}$ should not result in any significant impacts to the biological, physical, or social and economic environments.

For cobia the same set of alternatives for a range of F values to SPR percentages were evaluated in Action 10. However, a new stock assessment in 2001 showed that the yield associated with fishing at $F_{30\% SPR}$ could be more risk-prone. Furthermore, a direct estimate of F_{MSY} was determined to be nearly equivalent to $F_{35\%SPR}$. Based on this evaluation and the recommendations of the Council's MSAP and SSC, the direct estimate of MSY as the yield associated with fishing at F_{MSY} when the stock is at equilibrium was determined to be the most appropriate. Furthermore, because this definition would not change the management regime for cobia there should not be any significant impacts to the biological, physical, or social and economic environments.

OY Alternatives: As with MSY, the NMFS rejected the Council's proposed definition of OY at 40% static SPR for Gulf group king and Spanish mackerel as well as cobia in the Council's Generic Sustainable Fisheries Act Amendment because it was not specified in terms of biomass. This definition had also been recommended by the Council's Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP (1997). Again, when the Council reconsidered definitions of OY for both Gulf group king and Spanish mackerel, the Council evaluated identical alternatives as discussed in Actions 3 and 7.

For Gulf group king mackerel, the Council proposes to set the OY definition at the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.85*F_{MSY}$ when the stock is at equilibrium. If fished at this level, the yield relative to the F_{MSY} yield would be 95%. Based on previous advice from NMFS the yield associated with 0.75 * F_{MSY} would be 91% of the $F_{30\%SPR}$ proxy for F_{MSY} yield. Thus, the proposed OY would allow a yield that is only slightly less conservative than the NMFS recommendation, and the reduction in yield (95%) is closer to that envisioned by Restrepo et al. (1998) as stated above. Of the alternatives evaluated four offer equilibrium yields that are higher than the proposed alternative and four offer yields that are lower. In choosing this mid-point definition, the Council considered that: (1) the Gulf group king mackerel stock is not overfished nor undergoing overfishing based on proposed status criteria definitions; (2) recent years catches are over 2.0 MP below the current TAC of 10.2 MP (which is also the estimate of equilibrium yield at the proposed OY definition); (3) the spawning stock biomass has continued to increase since the early 1990s, thus the stock continues to grow; and (4) the impacts of setting a lower TAC based on a more conservative OY definition would only accrue to the commercial sector, would have minimal impact on overall catch because the recreational sector is allocated 68% of TAC, and such a lowering of TAC is not necessary or

required. Finally, the setting of the OY definition as proposed would not change the management regime for Gulf group king mackerel thus there would be no significant impacts to the biological, physical, or social and economic environments.

For Gulf group Spanish mackerel, the Council's proposed OY definition is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.75*F_{MSY}$ when the stock is at equilibrium. If fished at this level, the yield relative to the F_{MSY} yield would be 97%, and this OY definition is based on previous advice from NMFS. Although this level of potential yield would appear to be less precautionary than previously discussed for Gulf group king mackerel, Table 5 shows that like the alternatives for Gulf group king mackerel four offer equilibrium yields that are higher than the proposed alternative and four offer yields that are lower. Furthermore, the current spawning stock biomass is approximately 2.2 times the estimate of MSY, and the stock is neither overfished nor undergoing overfishing with recent years catches as less than half of MSY. The proposed OY definition would appear to be the most appropriate and would provide an adequate level of precaution against impacts that might threaten the stock if conditions in the fishery change to include significantly increased harvests. Furthermore, should harvests increase dramatically, there is sufficient excess biomass that additional regulations could be implemented in time to prevent the stock from becoming overfished. Finally, the setting of the OY definition as proposed would not change the management regime for Gulf group Spanish mackerel thus there would be no significant impacts to the biological, physical, or social and economic environments.

For cobia, the Council's proposed OY definition is the yield corresponding to a fishing mortality rate (F_{OY}) defined as: $F_{OY}=0.75*F_{MSY}$ when the stock is at equilibrium. This OY definition is based on previous advice from NMFS, and if the stock is fished at this level, the yield relative to the F_{MSY} yield would be 97%. As with Gulf group Spanish mackerel, this level of potential yield would appear to be less precautionary than previously discussed for Gulf group king mackerel; however, as noted under the Biological Environment section, cobia are fast growing, early maturing, and relatively short-lived when compared with Gulf group king mackerel. Consequently, setting an OY level that is closer to the MSY level is appropriate and retains sufficient caution against overfishing while maximizing benefits to users. As shown in Table 6, this OY level would result in a SSB/SSB_{MSY} of 130%. In terms of maintaining SSB, the proposed alternative is the second most conservative of those considered. The proposed OY would appear to be an appropriate management target, provide sufficient protection against overfishing, and not result in the need to change the current management regime. Consequently, there would be no significant impacts to the biological, physical, or social and economic environments.

Overfishing (MFMT) Alternatives: The MFMT proxy levels for Gulf group king and Spanish mackerel, as well as cobia were approved in the Council's Generic SFA Amendment as a F equivalent to a 30% static SPR. In reconsidering this definition through this regulatory amendment, the Council also considered a higher static SPR alternative (35% SPR) and a lower static SPR (25% SPR). The $F_{30\%SPR}$ proxy was determined to be the most appropriate based on the biology of Gulf group king and Spanish mackerel as previously discussed and was

recommended by the Ad Hoc Finfish Stock Assessment Panel (August 1998), as well as guidance from Mace et al. (1996) and MSAP (1997). Furthermore, as discussed in the Generic Sustainable Fisheries Act Amendment, use of a higher SPR for these stocks would likely overestimate MFMT and result in a more restrictive management regime than is needed to optimize yield. A lower SPR could underestimate MFMT and increase the risk of overfishing. In making its previously approved recommendation, the $F_{30\%SPR}$ was assumed to be a point estimate. As discussed under Actions 4 and 8, the stock assessments for Gulf group king and Spanish mackerel use a bootstrapping procedure that provides a range of probabilities for the $F_{CURRENT}/F_{MSY}$. Consequently, the Council considered probabilities or 30%, 40%, and 50% that $F_{CURRENT}>F_{MSY}$. As previously discussed, the 50% probability level is the most scientifically defensible and has been the criterion used for many years. Alternatives for lower probabilities are only slightly more risk-adverse. Since the current percentage of $F_{2001/02}/F_{30\%SPR}$ for Gulf group king mackerel is estimated at 50% (MSAP 2002), a lower percentage could trigger more stringent management measures if they continued at this level or higher. However, since the stock is not considered as overfished or undergoing overfishing no action would be required immediately at any of the percentage estimates. Consequently, without a change in the management regime for Gulf group king or Spanish mackerel, there would be no significant impacts to the biological, physical, or social and economic environments.

The proposed MFMT for cobia and the other alternatives evaluated are in essence the same as those discussed above for Gulf group king and Spanish mackerel. The only difference is that the MFMT (F_{MSY}) for cobia was initially evaluated by Williams (2001) directly, without additional evaluations of $F_{PERCENTSPR}$ proxies. Table 6 shows later calculations of $F_{25\%-45\%SPR}$ proxies. As shown, and in difference with similar calculations for Gulf group king and Spanish mackerel, the $F_{35\%SPR}$ (not $F_{30\%SPR}$) more closely follows SSB and yield. The Council felt that the direct estimate of F_{MSY}=MFMT was most appropriate. As with Gulf group king and Spanish mackerel, setting this definition would not change the management regime thus there would be no significant impacts to the biological, physical, or social and economic environments.

Overfished (MSST) Alternatives: As previously discussed, MSST is a threshold, and if the size of the spawning stock of a given species falls below this threshold it would be considered overfished; and a rebuilding plan would be needed to restore such stock to B_{MSY}. Actions 5, 9, and 13 evaluate the same slate of alternatives for MSST definitions for Gulf group king mackerel, Gulf group Spanish mackerel, and cobia, respectively. Three alternatives would set MSST at 1-M * B_{MSY} with probabilities of 30%, 40% and 50% that $B_{CURRENT}<$MSST. Three other alternatives would set MSST at 0.5 * B_{MSY} with the same 30%, 40%, and 50% probabilities that $B_{CURRENT}<$MSST. One alternative would be status quo and not set a MSST definition which is required, thus it is included for NEPA compliance only. The alternatives that use 1-M * B_{MSY} result in MSST definitions that are 80%, 70%, and 70% of B_{MSY} for Gulf group king mackerel, Gulf group Spanish mackerel, and cobia, respectively. The other 3 viable alternatives would set MSST at only 50% of B_{MSY}. Consequently, using alternatives for 1-M * B_{MSY} is considerably more conservative and risk-adverse and is the recommended approach by NMFS. Because the 50% probability level was determined to be the point estimate from the stock assessment, it represents the best available data. Finally, because none of the alternatives

would result in a change to the management regime, there would be no significant impacts to the biological, physical, or social and economic environments.

Conclusion

40 CFR§1508.27 identifies that both context and intensity need to be taken into account when evaluating the significance of impacts resulting from a major federal action. As discussed in Section IV, the preferred actions considered in this regulatory amendment are expected to have minimal effects on the fishery in the Gulf and the country as a whole. 40 CFR§1508.27(b) identifies 10 concepts that are needed to evaluate intensity. They are discussed below in conclusive form for the Gulf group king mackerel TAC and status criteria for Gulf group king mackerel, Gulf group Spanish mackerel, and cobia; however evaluations of significance using these concepts for each of the sets of alternatives (TAC, MSYs, OYs, MFMTs, and MSSTs) are discussed under each subsection of Section IV.

(1) Beneficial and Adverse Impacts: The preferred alternatives for Gulf group king mackerel TAC and status criteria for the three species considered in this regulatory amendment are expected to have no impacts in the immediate future. Long-term impacts cannot be determined without additional research. However, it should be noted that all the three species have been determined to be neither overfished nor undergoing overfishing. The preferred actions in this amendment do not propose any changes to the fishery as it currently operates and so there should not be any beneficial or adverse impacts.

(2) Public Safety: Maintaining the status quo TAC for Gulf group king mackerel and implementation of benchmark and status criteria measures would have no effect on public safety because there is no change introduced to either commercial or recreational fishing activities.

(3) Unique geographic areas: The alternatives considered in this amendment would not affect park lands, prime farmlands, wetlands, or wild and scenic rivers because those resources are onshore or nearshore, not in the EEZ. Mackerel and cobia fishing does occur in or adjacent to sensitive areas such as the Florida Middle Grounds HAPC, Dry Tortugas Ecological Reserve, the FKNMS, Madison-Swanson and Steamboat Lumps marine reserves, and the Flower Garden Banks National Marine Sanctuary. Most mackerel and cobia are caught with hook-and-line that are trolled or otherwise fished near the surface thus there would be minimal if any impacts to hard-bottom habitat. Gill nets are used in the fishery by 12 to 20 vessels only in the Keys. They have not been identified as potentially damaging to hard bottom habitats because they are fished in a "run-around" fashion and not attached to the seabed. If historic or cultural resources or sites currently exist or are designated in the EEZ, it is possible that coastal pelagic vessels could affect these sites (GMFMC, 2002). Hook-and-line gear could become entangled within those structures; however, this entanglement is likely to be minimal

because fishermen know of such locations, and they would likely avoid them to prevent losing fishing gear.

(4) Controversial effects on Human Environment: The alternatives considered in this document are not predicted to be controversial. The preferred TAC for Gulf group king mackerel is the status quo and recent total landings have remained well below this TAC. The status criteria measures are considered to provide adequate protection to the long-term sustainability of the stock, and currently would have no impact on the human environment.

(5) Uncertain, Unknown, or Unique Risks: Defining biological reference points and stock status determination criteria, and maintaining the status quo TAC for Gulf group king mackerel would not pose any uncertain, unknown, or unique risks to the mackerel and cobia industry or to others, other than potential future economic and social impacts due to additional regulations as discussed in previous sections because there are no management actions proposed.

(6) *Precedence*: The proposed actions do not establish new precedence. Biological reference points, stock status criteria measures, and TAC setting for Gulf group king mackerel have been implemented in the Coastal Migratory Pelagics FMP and other Gulf of Mexico fisheries. Furthermore, the framework procedure of the Coastal Migratory Pelagics FMP provides that these definitions be evaluated periodically as additional data are collected.

(7) *Cumulative impacts*: As previously discussed, the implementation of status criteria measures and maintaining the status quo TAC for Gulf group king mackerel would not cause direct, cumulative impacts to the biological or physical environment. The cumulative impacts of previous actions to manage Gulf group king and Spanish mackerel stocks, as well as cobia have had a positive impact on the environment through recovery of the Gulf group king and Spanish mackerel stocks and maintenance of a healthy cobia stock.

(8) Adverse effects on resources: The effects of the proposed and rejected alternatives for implementation of status criteria measures and the TAC for Gulf group king mackerel would not apply to any sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or cause loss or destruction of significant scientific, cultural or historical resources. Should such structures or resources be located in the EEZ, it is possible that coastal pelagic vessels could damage these sites. Hook-and-line gear could become entangled within those structures; however, this entanglement is probably minimal because fishermen would avoid losing fishing gear.

(9) Endangered Resources: An informal Section 7 consultation has been conducted by NMFS Office of Protected Resources regarding the proposed and rejected alternatives as

to their impact on threatened or endangered species. The implementation of status criteria measures and the status quo TAC for Gulf group king mackerel are unlikely to have any additional impact on endangered species because these actions would not change current fishing practices.

(10) Other environmental laws: The effects of the implementation of status criteria measures and the status quo TAC for Gulf group king mackerel would not have an impact on state or local regulations outside the EEZ, and would not create a conflict with any other federal law or regulation applicable to the EEZ. Alternatives for SFA criteria and the TAC for Gulf group king mackerel, to the extent that they provide additional protection for marine resources and a measure of their relative health, would only compliment state and federal laws that likewise provide protection.

Based on the analyses and discussions in this document, including its EA, and in the other referenced documents and sections herein, I have determined that the proposed action would not significantly affect the biological, physical or human environment, including EFH, and that preparation of a supplemental environmental impact statement is not required by Section 102(2)(c) of NEPA or its implementing regulations.

Approved:_____ _____
Assistant Administrator for Fisheries Date

VI. OTHER APPLICABLE LAWS

Vessel Safety Considerations

The preferred alternative for Gulf group king mackerel TAC (10.2 MP - status quo) as well as setting status criteria for the three species managed under the Coastal Migratory Pelagics FMP in this regulatory amendment are not expected to affect vessel safety. A determination of whether there would be vessel safety issues with regard to compliance with 50 CFR 605.15(b)(3) will be requested from the U.S. Coast Guard.

Coastal Zone Management Consistency

Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972 requires that all federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. The proposed actions to set status criteria and benchmarks for Gulf group king and Spanish mackerel as well as TAC for Gulf group king mackerel will make no changes in federal regulations that are inconsistent with the coastal zone management programs of any Gulf state. A

determination of consistency will be sent to each state for their concurrence with this statement.

Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to control paperwork requirements imposed on the public by the Federal Government. The authority to manage information collection and record keeping requirements is vested with the Director of the Office of Management and Budget. This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

The Council does not propose, through this regulatory amendment, to establish any reporting requirements or burdens.

Federalism

No federalism issues have been identified relative to the actions to set status criteria and benchmarks for Gulf group king and Spanish mackerel as well as TAC for Gulf group king mackerel proposed in this regulatory amendment. Therefore, preparation of a federalism assessment under Executive Order 12612 is not necessary.

VII. PUBLIC REVIEW

List of Agencies Consulted:

Gulf of Mexico Fishery Management Council's
- Scientific and Statistical Committee
- Mackerel Stock Assessment Panel
- Socioeconomic Assessment Panel
- Mackerel Advisory Panel

South Atlantic Fishery Management Council

National Marine Fisheries Service
- Southeast Fisheries Science Center
- Southeast Regional Office

Partial List of Organizations Consulted:

- Concerned Fishermen of Florida

- Organized Fishermen of Florida
- Monroe County Commercial Fishermen, Inc.
- Coastal Conservation Association
- Southeast Fisheries Association

Responsible Agency:

Gulf of Mexico Fishery Management Council
3018 U.S. Highway 301, North
Suite 1000
Tampa, Florida 33619-2266
813-228-2815

List of Preparers:

Gulf of Mexico Fishery Management Council
Dr. Richard L. Leard, Senior Fishery Biologist
Dr. Antonio Lamberte, Economist

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IX. TABLES

Table 1. Gulf group king mackerel management regulations and harvest levels. Pounds are in millions.

Fishing Year	ABC RANGE[12] (lbs.)	TAC (lbs.)	Rec. Alloc./Quota[3] (lbs. / numbers)	Rec. Bag Limit[4]	Commercial Allocation	East/West-EC/WC-North-South [5,6]	Annual Harvest Levels		
							Com	Rec	Total
1986/87	1.2-2.9	2.9	1.97	2/3 FL-TX	0.93 :	0.60/0.27 + PS=0.06	1.473	3.269	4.742
1987/88	0.6-2.7	2.2	1.50	2/3 FL-TX	0.70 :	0.48/0.22	0.868	2.145	3.013
1988/89	0.5-4.3	3.4	2.31	2/3 FL-TX	1.09 :	0.75/0.34	1.405	5.276	6.681
1989/90	2.7-5.8	4.25	2.89 / 298,000	2/3 FL-TX	1.36 :	0.94/0.42	1.954	3.360	5.314
1990/91	3.2-5.4	4.25	2.89 / 301,000	2/3 FL-TX	1.36 :	0.94/0.42	1.816	3.951	5.767
1991/92	4.0-7.0	5.75	3.91 / 574,000	2 FL; 2/3 AL-TX	1.84 :	1.27/0.57	2.117	4.773	6.890
1992/93	4.0-10.79	7.80	5.30 / 715,000[8]	2 FL-TX	2.50+0.259 :	1.73+0.259/0.77[7]	3.599	6.258	9.857
1993/94	1.9-8.1[9]	7.80	5.30 / 759,000	2 FL-TX	2.50 :	1.73/0.77	2.572	6.146	8.718
1994/95	1.9-8.1[9]	7.80	5.30 / 768,000	2 FL-TX	2.05+0.300 :	1.73+0.300/0.77[10]	2.901	7.948	10.849
1995/96	1.9-8.1[9]	7.80	5.30 / 629,000	2 FL-TX	2.50 :	1.73/0.77	2.645	6.265	8.910
1996/97	4.7-8.8	7.80	5.30 / 629,000	2 FL-TX	2.50 :	1.73/0.77	2.864	6.933	9.797
1997/98	6.0-13.7	10.6	7.21	2 FL-TX	3.39 :	2.34/1.05	3.445	6.634[1]	10.08
1998/99	7.1-10.8	10.6	7.21	2 FL-TX	3.39	2.34/1.05	3.895	5.235	9.130
1999/00	8.0-12.5	10.6	7.21	2 FL-TX	3.39	2.34/1.05	2.974	3.994	6.968
2000/01	5.5-8.8	10.2	6.94	2 FL-TX	3.26	3.25/1.01-1.04/1.21-0.169/1.04	3.077	4.951	8.028

[1] Fishing year 1979/80 begins on 1 July 1979 and ends on 30 June 1980.
[2] Sums within rows may not appear to equal the total value shown due to rounding of numbers before printing.
[3] Recreational quota in numbers is the allocation divided by an estimate of annual average weight (not used prior to fishing year 1989).
[4] Bag Limit "2/3" means 2 for private boats; for charterboats: 2 with, or 3 without, captain and crew.
[5] E/W com. allocations apply to all legal gears except purse seine in fishing year 1986 and are divided at the FL/AL Border (only H&L and runaround gillnet beginning 1990/91).
[6] East Zone allocations are divided into East Coast FL and West Coast FL, and West Coast FL is divided into North and South subzones.
[7] 0.250 million pounds added to com. allocation for FL east only, opened 2/18/93 - 3/26/93.

[8] Bag limit will not be reduced to zero when allocation reached, beginning in fishing year 1992/93.
[9] Panel recommended ABC range changed from 16%-84% to 16%-50% and Gulf Council selected TAC accepting greater than 50% risk level.
[10] 0.300 million pounds added to hook-and-line quota for Florida West Coast subzone.
[11] Recreational landings, in pounds were estimated by multiplying number of fish caught by 10.77 lbs/fish.
[12] The range has been defined in terms of acceptable risk of achieving the FMP's fishing mortality rate target; the Panel's best estimate of ABC has been intermediate to the end-points of this range.
[13] Estimated catch equal to the recreational allocation of TAC.

Table 2. Gulf group Spanish mackerel management regulations. Pounds are in millions. Prior to fishing year 1990, management was based upon a July-June fishing year. The regulations shown for fishing year 1987 and later are relative to the July-June fishing year.

Fishing Year	ABC RANGE[1] (lbs)	TAC (lbs)	Rec. Alloc./Quota[2] (lbs / numbers)	Rec. Bag Limit	Com. Alloc. (lbs)	Annual Harvest Levels[3]		
						Com	Rec	Total
1987/88	1.9 - 4.0	2.50	1.08	3	1.42	2.581	3.124	5.705
1988/89	1.9 - 7.1	5.00	2.15	4 FL, 10 AL-TX	2.85	3.902	2.177	6.079
1989/90	4.9 - 6.5	5.25	2.26 / 1,614,000	4 FL, 10 AL-TX	2.99	2.145	1.856	4.001
1990/91	3.9 - 7.4	5.25	2.26 / 1,569,000	3 TX, 4 FL[4], 10 AL-LA	2.99	2.074	2.138	4.213
1991/92	7.1 - 12.2	8.60	3.70 / 2,721,000	3 TX, 5 FL, 10 AL-LA	4.90	4.163	2.889	7.053
1992/93	5.1 - 9.8	8.60	3.70 / 3,274,000[5]	7 TX, 10 FL-LA	4.90	3.113	3.130	6.243
1993/94	4.7 - 8.7	8.60	3.70 / 3,274,000	7 TX, 10 FL-LA	4.90	2.614	2.696	5.309
1994/95	4.4 - 8.7	8.60	3.70 / 2,202,000	7 TX, 10 FL-LA	4.90	2.544	1.556	4.100
1995/96	4.0 - 10.7	8.60	3.70 / 2,782,000	7 TX, 10 FL-LA	4.90	1.075	1.575	2.650
1996/97	1.6 - 9.5	7.00	3.01 /	7 TX, 10 FL-LA	3.99	0.617	2.042	2.659
1997/98	5.5 - 13.9	7.00	3.01 /	7 TX, 10 FL-LA	3.99	0.356	2.455	2.810
1998/99	7.3-14.1	7.00	3.01 /	7 TX, 10 FL-LA	3.99	1.074	2.080	3.154
1999/00	9.1 - 17.1	9.1	3.9 /	7 TX, 10 FL-LA	5.2	1.056	3.355	4.411
2000/01	9.1 - 17.1	9.1	3.9 /	15 TX - FL	5.2	1.036	2.964	3.999

[1] The range has been defined in terms of acceptable risk of achieving the FMP's fishing mortality rate target; the Panel's best estimate of ABC has been intermediate to the end-points.
[2] Recreational quota in numbers is the allocation divided by an estimate of annual average weight (not used prior to fishing year 1989).
[3] Sums within rows may not appear to equal the total value shown due to rounding of numbers before printing.
[4] Rec. bag limit in Fl changed from 4 to 5 on 1/1/91, and changed from 5 to 10 on 1/1/93.
[5] Bag limit will not be reduced to zero when allocation reached, beginning fishing year 1992
[6] Estimated catch equal to the recreational allocation of TAC.

Table 3. Recreational, commercial, and total landings of cobia from the Gulf of Mexico, 1980-2000 in pounds.

Year	Commercial	Recreational	Total
1980	99,312		99,312
1981	118,090	899,959	1,018,049
1982	110,310	909,701	1,020,011
1983	132,416	920,677	1,053,093
1984	142,246	893,590	1,035,836
1985	136,229	533,500	669,729
1986	159,459	1,382,327	1,541,786
1987	174,491	875,561	1,050,052
1988	161,355	1,346,093	1,507,448
1989	211,121	858,678	1,069,799
1990	161,112	763,355	924,467
1991	176,849	1,201,246	1,378,095
1992	235,101	935,311	1,170,412
1993	261,108	1,132,349	1,393,457
1994	263,907	1,396,300	1,660,207
1995	240,699	1,002,820	1,243,519
1996	262,320	1,634,134	1,896,454
1997	210,592	2,234,459	2,445,051
1998	202,415	1,065,149	1,267,564
1999	165,256	1,087,983	1,253,239
2000	137,882	1,037,864	1,175,746

Source: Erik Williams, NMFS

Table 4. Equilibrium yield in millions of pounds and spawning stock biomass in trillions of eggs for Gulf group king mackerel at various benchmarks.*

Benchmark	Fishing Mortality	Equilibrium Yield	Yield/MSY	Spawning Biomass	SSB/SSB_{MSY}
F MSY	0.252	10.7	1.00	6.1	1.00
0.65 F MSY	0.164	9.3	0.87	8.6	1.40
0.75 F MSY	0.189	9.8	0.91	7.7	1.27
0.85 F MSY	0.214	10.2	0.95	7.0	1.15
0.90 F MSY	0.227	10.4	0.97	6.7	1.10
F 25%SPR	0.306	11.2	1.05	5.1	0.84
F 30%SPR	0.253	10.8	1.00	6.1	1.01
F 35%SPR	0.210	10.2	0.95	7.2	1.18
F 40%SPR	0.177	9.6	0.89	8.2	1.34

*For king mackerel the MSAP adopted a combined model [Base10 & CAA00] in the 2002 MSAP evaluation
Source: Mauricio Ortiz, NMFS

Note: Variations in values related to FMSY and F30%SPR are caused by variations in the random draws of the assessment model in the bootstrapping process and projecting results into the future.

Table 5. Equilibrium yield and spawning stock biomass for Gulf group Spanish mackerel at various benchmarks in millions of pounds.*

Benchmark	Fishing Mortality	Equilibrium Yield	Yield/MSY	Spawning Biomass	SSB/SSB_{MSY}
F MSY	0.559	8.6	1.00	18.6	1.00
0.65 F MSY	0.363	8.1	0.94	23.8	1.28
0.75 F MSY	0.419	8.3	0.97	22.0	1.19
0.85 F MSY	0.475	8.5	0.99	20.5	1.10
0.90 F MSY	0.503	8.5	0.99	19.8	1.07
F 25%SPR	0.738	8.8	1.03	15.7	0.84
F 30%SPR	0.559	8.7	1.01	18.6	1.02
F 35%SPR	0.430	8.4	0.98	21.9	1.18
F 40%SPR	0.334	8.0	0.93	25.1	1.35

* For Spanish mackerel projections start in 1997 for Atlantic stock and 1999 for Gulf stock
Source: Mauricio Ortiz, NMFS

Note: Variations in values related to FMSY and F30%SPR are caused by variations in the random draws of the assessment model in the bootstrapping process and projecting results into the future.

Table 6. Equilibrium yield and spawning stock biomass for cobia at various benchmarks in millions of pounds.*

Benchmark	Fishing Mortality	Equilibrium Yield	Yield/MSY	Spawning Biomass	SSB/SSB_{MSY}
F_{MSY}	0.330**	1.489	1.00	3.023	1.00
$0.65F_{MSY}$	0.215	1.405	0.94	4.388	1.45
$0.75F_{MSY}$	0.248	1.452	0.97	3.922	1.30
$0.85F_{MSY}$	0.281	1.476	0.99	3.523	1.17
$0.90F_{MSY}$	0.297	1.484	1.00	3.344	1.11
$F_{25\% SPR}$	0.514	1.381	0.93	1.821	0.60
$F_{30\% SPR}$	0.406	1.467	0.98	2.429	0.80
$F_{35\% SPR}$	0.329	1.489	1.00	3.040	1.01
$F_{40\% SPR}$	0.270	1.470	0.99	3.647	1.21

*William E.H. Assessment of cobia, Rachycentron canadum, in the waters of the U.S. gulf of Mexico. NOAA Tech. Memo., NMFS-SEFSC-469, 55p.

**80% confidence intervals associated with this value are (-0.19, 0.85), indicating the odds of discriminating this value from any other of the proposed benchmarks is near zero.

Source: NMFS, Stock Assessment Model with M=0.3, Updated 9/17/02.

Note: Variations in values related to FMSY and F35%SPR are caused by variations in the random draws of the assessment model in the bootstrapping process and projecting results into the future.